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TSHIN

panel material didactic

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BIOMEDICAL ENGINEERING

BIOMEDICAL ENGINEERING

Biomedical engineering is the application of engineering principles to life sciences. It combines the logic of engineering design and the analysis tools of mathematics, physics, chemistry, biology, biotechnology, pharmacy, etc. Biomedical engineering is the midpoint between Telecommunications, Electronics, Computer Science and Life Sciences: Medicine, Pharmacy, Biology, Biotechnology... With our training systems, De Lorenzo aims to address the training of biomedical technical engineers and biomedical laboratories. That is why the objective of our laboratories is the development of their skills so that they are able to develop professionally in the work environment of the biomedical industry, in terms of the design, manufacture, maintenance and repair of biomedical equipment. At De Lorenzo, we always pay attention to the improvement, quality and development of the skills of future professionals of the 21st century.

SOLUTION LABORATORY BIOMEDICAL ENGINEERING

Read more

POWER SUPPLIES AND SOFTWARE

The training of professionals in Biomedical Engineering with practical skills and not only theoretical knowledge is a challenge that has always existed in education. Practice allows the engineer and technician to be able to make decisions, design, build, etc. This is why our modules have interconnected theory and practices that allow students to gradually learn and provide teachers with tools...

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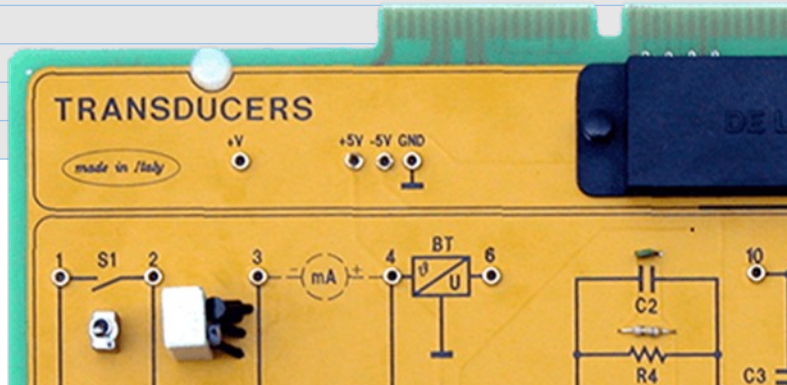

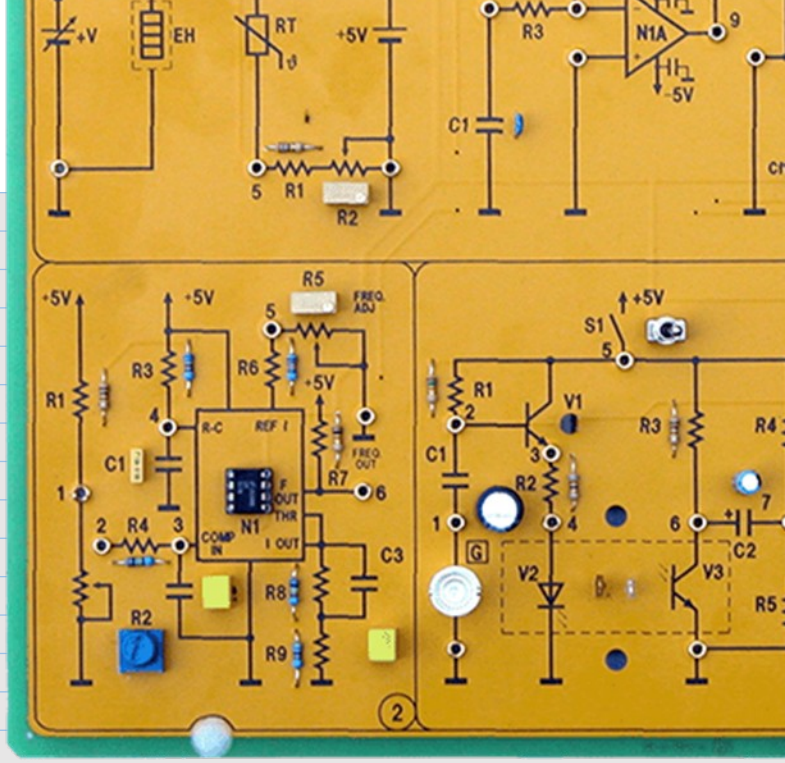

TRANSDUCERS AND SIGNAL CONDITIONING

Basically, these modules convert a biological signal of interest (blood pressure, action potentials, glucose concentration, temperature, etc.) into an electrical signal that can be processed and administered either analogically or digitally. With these teaching modules students will develop practices in the use of resistive, optical and/or photoelectric sensors and transducers, used in tempera...

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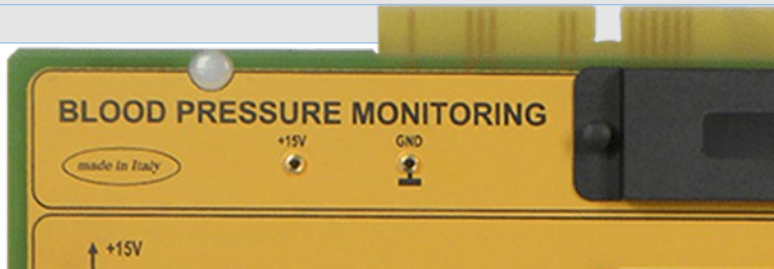

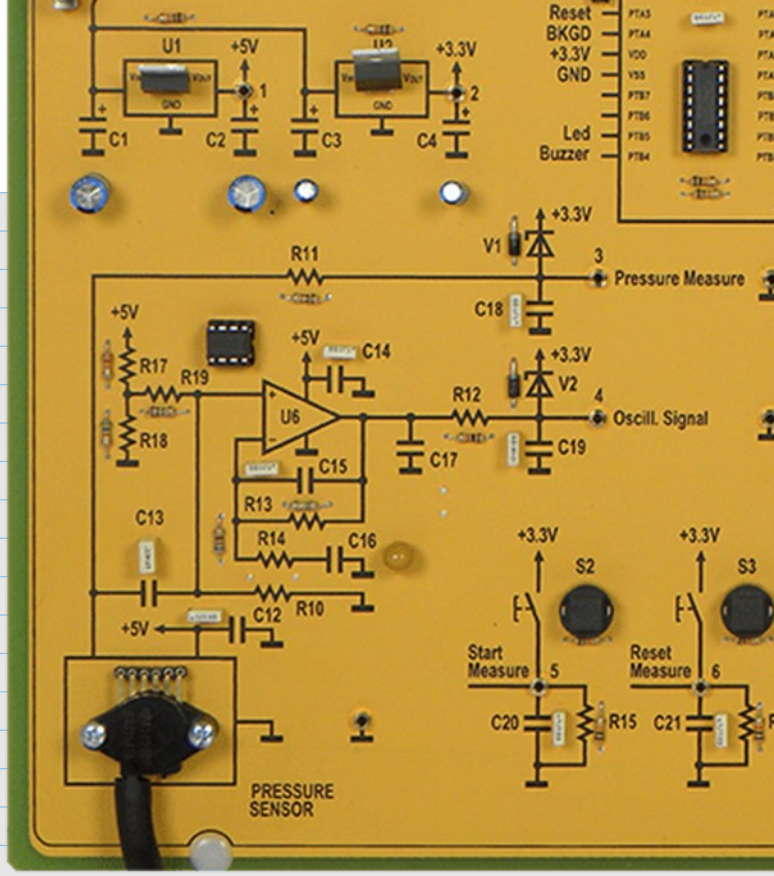

BODY MONITORING

Bioelectrical potentials are ionic voltages produced as a result of the electrochemical activity of certain types of cells called excitable cells, which can be nervous, muscular and glandular. Their registration requires sensors, capable of converting ion flows into electrical currents that provide complementary information for medical diagnosis and treatment. The educational goal of each o...

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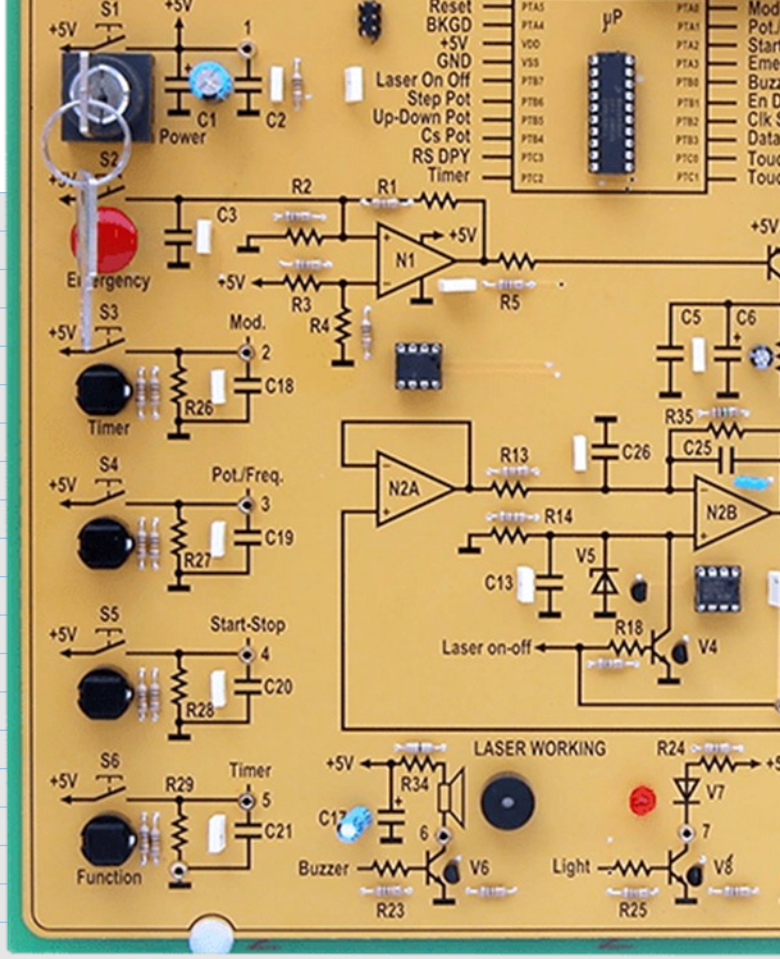

THERAPY

Therapies are fundamentally complementary methods of rehabilitation in disabling processes, such as certain acute and chronic rheumatological or neurological diseases. Another fundamental use is the relief of painful processes, mainly trauma, but also as a means of relieving muscle spasms. There is a wide range of equipment on the market, that is why Biomedical doctors must be trained in the k...

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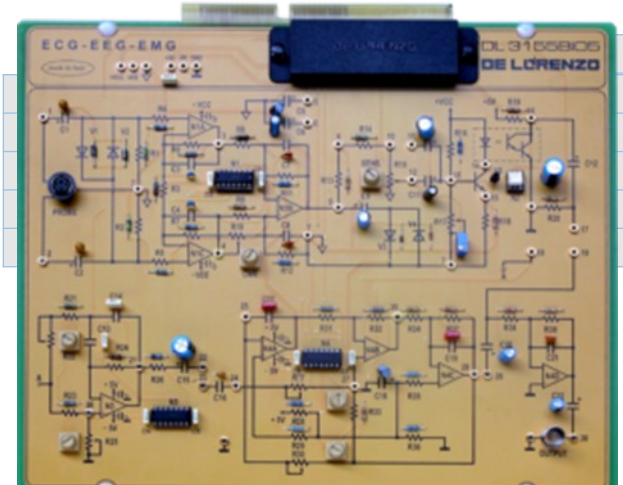
BIOMEDICAL ENGINEERING

BODY MONITORING

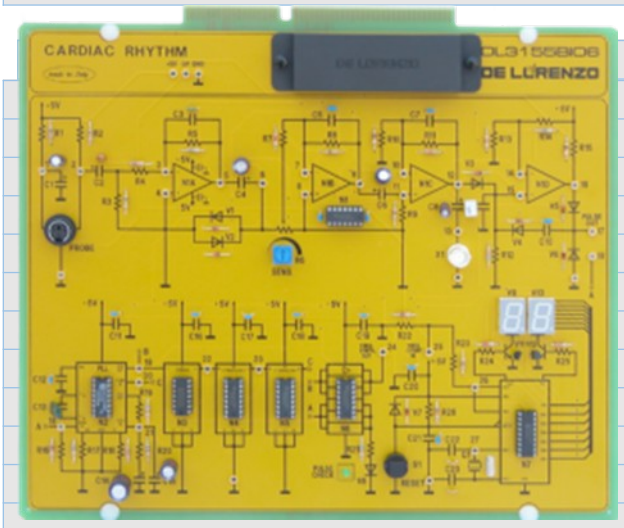
BODY MONITORING

Bioelectrical potentials are ionic voltages produced as a result of the electrochemical activity of certain types of cells called excitable cells, which can be nervous, muscular and glandular. Their registration requires sensors, capable of converting ion flows into electrical currents that provide complementary information for medical diagnosis and treatment. The educational goal of each of the didactic systems offered in this biomedical line is that students know and understand the operation of the devices, the general specifications of their systems and their control characteristics.



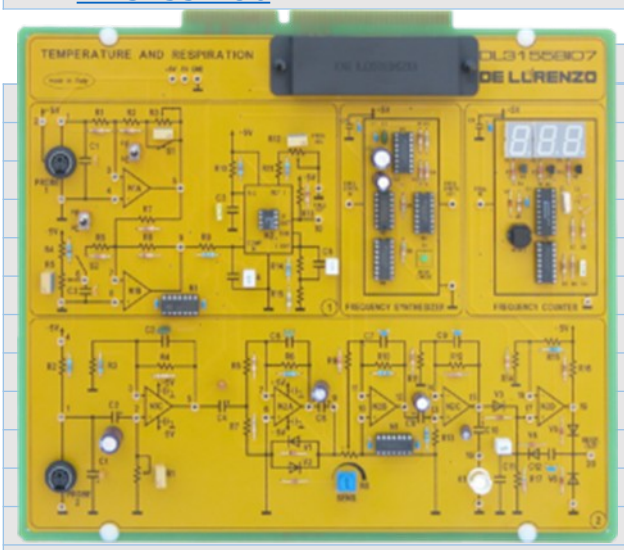
ECG – EEG – EMG

DL 3155BIO5



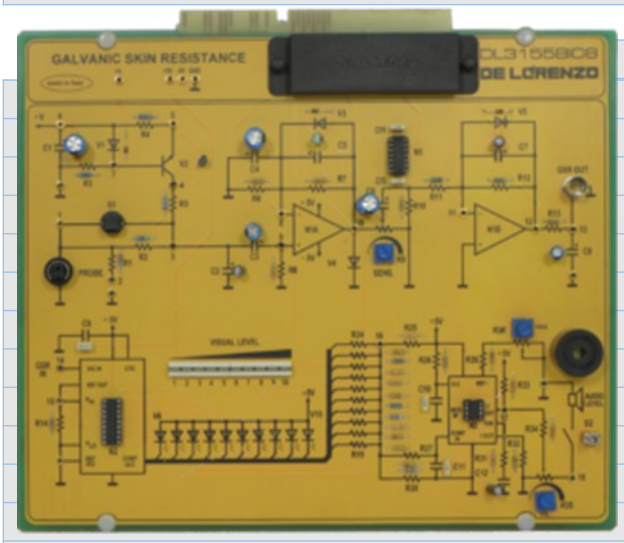
CARDIAC RITHM

DL 3155BIO6



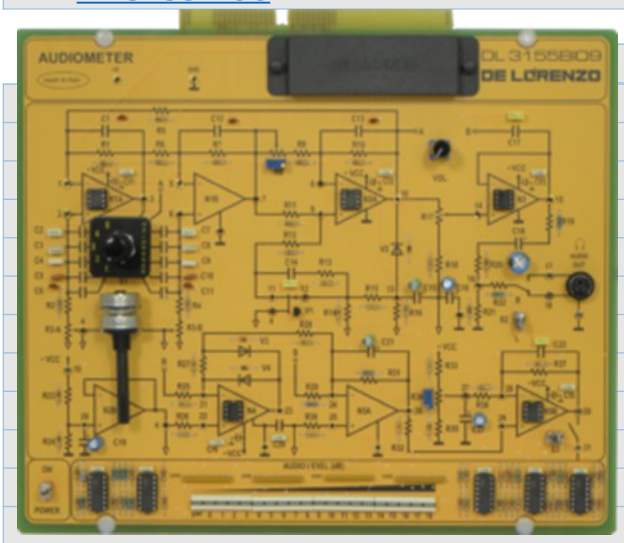
TEMPERATURE AND RESPIRATION

DL 3155BIO7



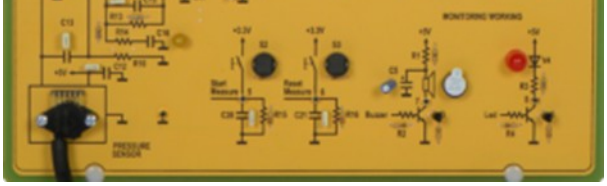
GALVANIC SKIN RESISTANCE

DL 3155BIO8



AUDIOMETER

DL 3155BIO9



BLOOD PRESSURE MONITORING

DL 3155BIO16

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TIME ELECTRONIC BOARDS

www.delorenzoglobal.com

AUDIOMETER
DL 3155BIO9

The design and construction of electronic circuits to solve practical problems is an essential technique in the fields of electronic engineering and computer engineering.

The audiometer is used in the medical field to measure the threshold of hearing sounds. An audio signal generator generates all the frequencies between 20 Hz and 25 kHz. The patient, through a headset, checks the level of sensitivity in his ears.

THEORETICAL TOPICS

- Biophysics of sounds €
- Physiology of the auditory system: perception, transmission and conduction of the sound €
- Diagnosis and evaluation of the acoustic deficit €
- Audiometer €

CIRCUIT BLOCKS

- Typical circuit of an audiometer €
- Graphical visualization of the hearing sensitivity of a patient in the whole frequency range €

Complete with theoretical and practical

manual.

Dimensions of the board: 297x260mm

This board does not substitute the medical device under study. The results of the experiments have no medical

value. They are just for demonstration purposes.

CAI SOFTWARE:

Each board of the TIME system can be supplied complete with a Student Navigator software that allows students to perform
their learning activities through a Personal Computer, without the need for any other documentation.

Ordering code: please add SW after the code of the board (i.e. DL 3155BIO9SW)

Required:

POWER SUPPLY NOT INCLUDED

Base frame with power supply (completed with connecting cables):

➢ **DL 3155AL3** - Base frame with power supply and interface to pc and virtual instrumentation

➢ **DL 3155AL2** - Base frame with power supply and interface to pc

Basic power supply (connecting cables not included):

➢ **DL 2555ALF -** DC power supply ±5 ±15 Vdc 0±15 Vcc, 1A

➢ **TL 3155AL2 -** Connecting cables

Choosing this power supply, for the execution of the experiments, it is normally required the use of an oscilloscope and two multimeters.

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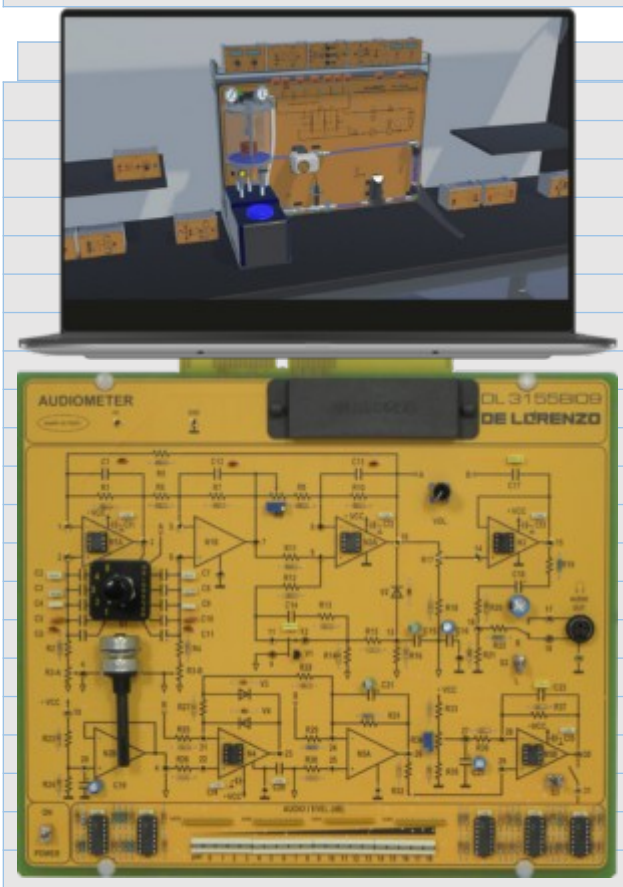

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DE LORENZO

MECHANICS

Mechanics is the discipline that studies the motion of bodies. In turn, based on the subject of study, it can be divided into multiple fields such as; classical mechanics, statistical mechanics, relative mechanics. De Lorenzo has developed a laboratory for the study of various aspects related to mechanics, specifically for the assembly and physics associated with the movement of bodies.

MECHANICAL ASSEMBLY

Mechanical assembly cover a fundamental role in production processes. Improved efficiency in this phase results in quick delivery times and lower production costs. It is therefore deduced that technicians trained in mechanical assembling parts and related problems is a fundamental figure in all company production sectors. De Lorenzo offers various benches for technical and practical training and...

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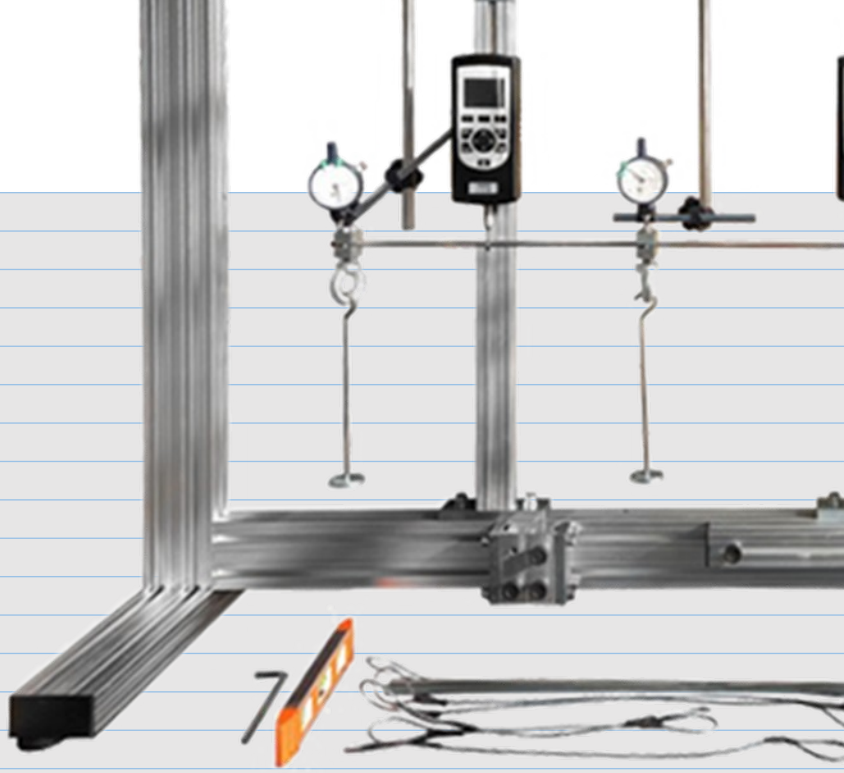

MECHANICAL PHYSICAL PHENOMENA

Mechanics is nothing more than a derivation of the main discipline, physics. In this section it is possible to find didactic systems suitable for studying the main physical phenomena related to the movement of bodies.

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MECHANICS

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DIDACTIC SYSTEM FOR THE STUDY AND TRAINING IN BEAMS AND

FRAMES WITH DYNAMOMETERS AND

SOFTWARE
DL ST033

The modular training system **DL**
ST33 allows users to study
theoretical-practical assemblies
involving beams and gates, to
measure with two electronic
dynamometers and to visualize
the applied force values
graphically on PC (not included).
Dynamometers can be used in
the customer's laboratory for
other educational activities.

The system uses an extremely robust 1400 x
1100 x 500 mm primary structure, which allows
a weight of up to 34kg and to which the test
structures are attached.

The set allows the installation of comparators,
cells and pulleys for the study of loads and
deformations in different test structures (flat).

The structure under test is secured with steel
connectors, allowing easy disassembly with an
Allen key. The beams / frames are made of
polished AISI-304 stainless steel.

The beams and frames have a 200 Gpa elastic
module. Initially, the system is modular and can
be exchanged in activities. The system enables
activities and measurements with the help of
typical metrology lab instruments.

EDUCATIONAL ACTIVITY

• Study of hardware support, fixings and
their impact on measurements

• Metrological measurement practices	
• Overlay study	
• Deformation study of beams resting on	
one or two points	
• Frame deformation study	
• Comparison between calculated and	€
measured deformations	
The product includes the software and exercise	
manual.	

MECHANICS

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U + V GATE STRUCTURES

The purpose of these test structures is to study deformation in the plane under the action of applications.

The equipment is supplied with two gates, one U type and one “roof” type.

The assembly has a snap-in system and a sliding pivot bracket. The recorded deformation is extracted from

the system using 2 comparison clocks that are placed anywhere on the frame.

These deformations are the response of the system to different applied loads. The loading of the test frame

is carried out by means of 2 load systems with weights, the maximum load of which is 12 kg, with different

mass weights from 0.5 to 2.5 kg.

BEAM STRUCTURE

The purpose of this test structure is to study the deformation in a plane of continuous beams under the
action of loads. The assembly has an insert system and sliding articulated supports, with dynamometer.
The recorded deformation is extracted from the system by means of 3 dial gauges which can be placed at
any point on the beam. These deformations are the response of the system to different applied loads. The
loading of the test frame is achieved by means of 2 load systems with weights, whose maximum load is 12
kg, the weights are of different masses, from 0.5 to 2.5 kg. The equipment is supplied with 2 beams of
different sections, i.e. 20x5mm and 20x3mm.
DYNAMOMETRIC METERS
The system is accompanied by two dynamometric gauges that allow the application of precise stresses with
a measured value.
Both dynamometers have a USB port and both can be connected to two USB ports on a non-supplied laptop.
The supplied acquisition software allows you to view both channels and view graphs.
Each dynamometer can also be used in other laboratory applications.
Main elements provided
a) Tin plated bronze weights
o 3 x 2.5 kg
o 3 x 1.0 kg
o 2 x 0.5 kg
b) 4 x steel hooks
c) Fasteners
d) Adjust items
e) 1 meter, 200 mm and 500 mm steel cables

f) Cable ties for placing loads

g) Sliding dynamometric support (two pieces)

h) Three dial indicators

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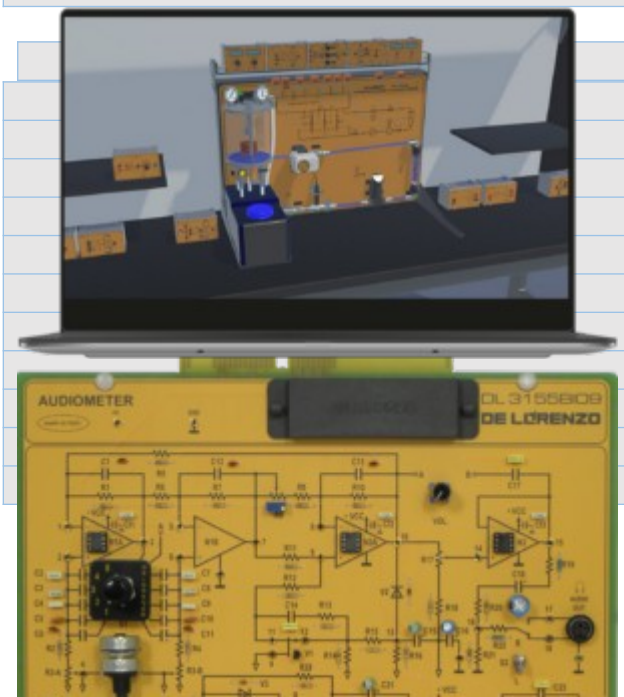
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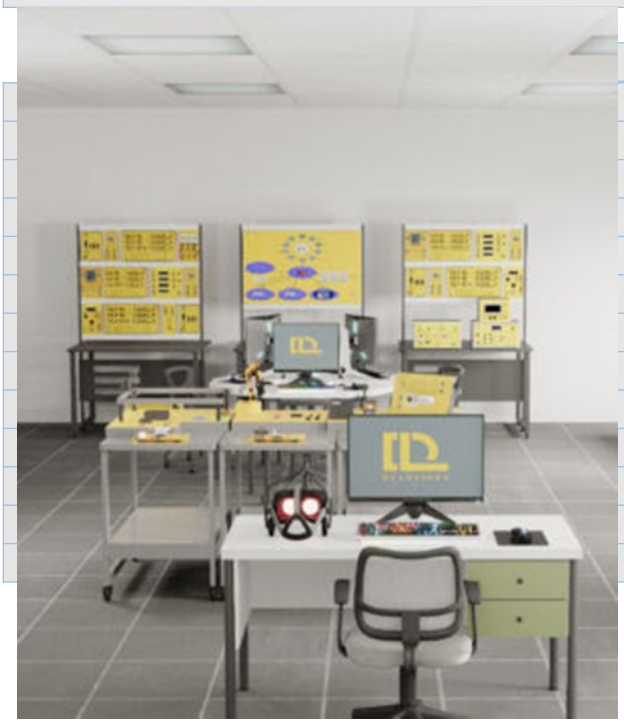
DL NEXT GENERATION LAB

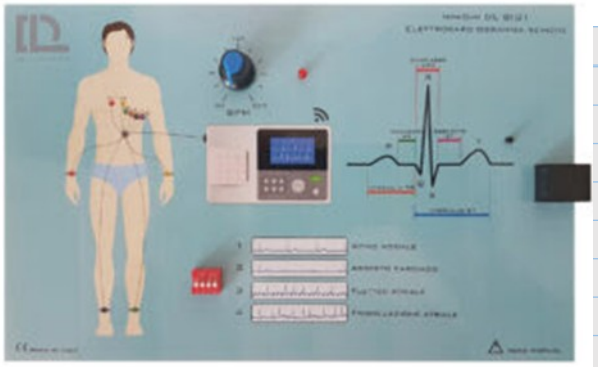
DL NEXT GENERATION LAB

The Laboratory has a modular structure and is made up of a basic module, which contains the devices and tools to implement the Internet network and all its functions, a software that provides an integrated work environment in which all the tools are placed for study and experimentation, workstations for teacher and students and dedicated modules, consisting of devices and/or application software, for the following sectors: Robotics and Automation, Augmented and Virtual Reality, Blockchain, Cybersecurity, Internet of Things, Big Data, Cloud Computing, 3D/4D Modeling and Printing, Artificial Intelligence, Electronic Commerce, Intelligent Greenhouse and Factory I4.0. The modularity of the system allows the different modules to coexist within the laboratory without mutual limitations, allowing maximum flexibility of use. Students can work individually or in groups. The Student Stations are all connected to each other and to the Teacher Station by the Internet.



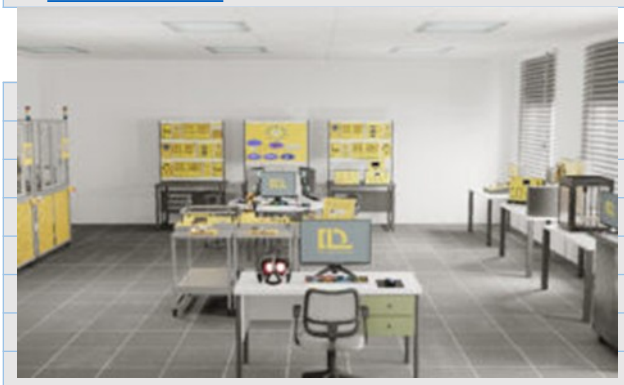
NEXT GENERATION LABS

DL NGL LAB



DIDACTIC SIMULATORS FOR IoT

DL MINI-SIM



DIGITAL ENVIRONMENT FOR THE STUDY IN THE DL NGL LABORATORY

DL WORKSPACE

MODULE FOR THE STUDY OF ARTIFICIAL INTELLIGENCE

DL NGL AI

MODULE FOR THE STUDY OF A CONVEYOR BELT

DL NGL-CIMSIM

MODULE FOR THE STUDY OF CLOUD COMPUTING

DL NGL-CLOUD

MODULE FOR THE STUDY OF CYBERSECURITY

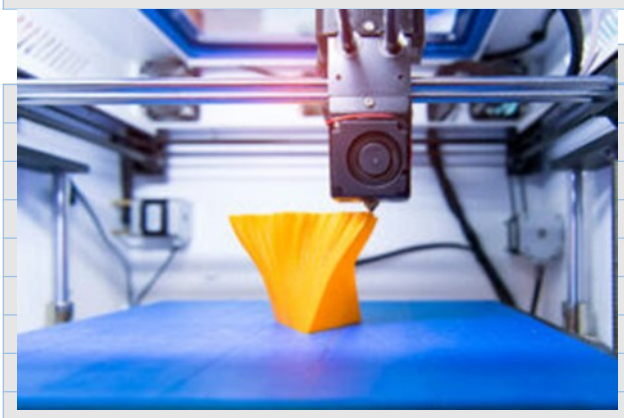
DL NGL-CYBER

MODULE FOR THE STUDY OF BIG DATA

DL NGL-DATA

MODULE FOR THE STUDY OF A SMART FACTORY

DL NGL-I4.0FACTORY

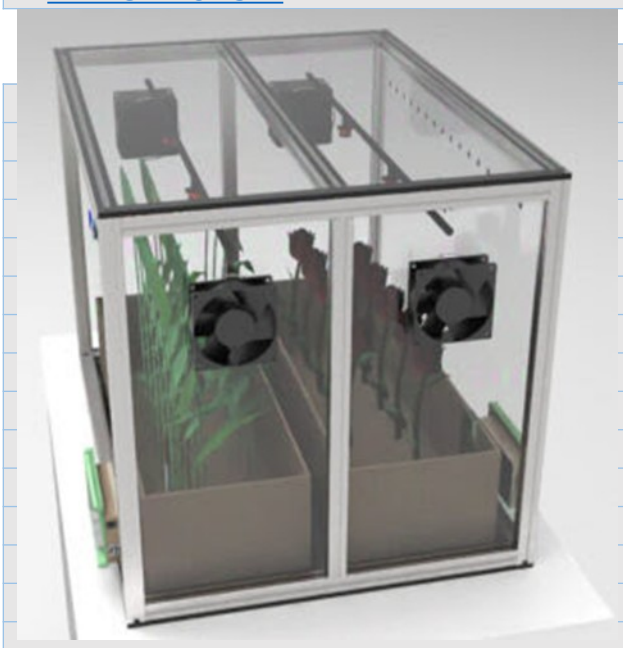


MODULO PER LO STUDIO DEL MAKING E MODELLAZIONE E STAMPA 3D/4D

DL NGL-FABLAB

MODULE FOR THE STUDY OF 5-AXIS ROBOTIC ARM

DL NGL-ROBSIM



MODULE FOR THE STUDY OF A SMART GREENHOUSE

DL NGL-GREENSTEM

MODULE FOR THE STUDY OF VIRTUAL REALITY AND AUGMENTED REALITY

MODULE FOR THE STUDY OF THE INTERNET OF THINGS

DL NGL-IOT

MODULE FOR THE STUDY OF THE BLOCKCHAIN

DL NGL-BLOCK

MODULE FOR THE STUDY OF E-COMMERCE

DL NGL-ECOM

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DL NGL

NEXT GENERATION LABS

DL NGL-CLOUD

Module for the study of cloud computing

DL NGL

The 'Cloud Computing' module contains devices and tools for analysing and experimenting at an educational

level with this latest generation information technology that allows managing processing resources on

remote devices, connected to the Internet, which allow for global use of the contents.

The Cloud Computing paradigm is gaining more and more ground in corporate IT innovation, as it allows

renting processing resources "on demand", without the need to manage the necessary machines (servers)

on site, reducing maintenance costs (breakage of hardware components, addition of processing resources

such as CPU, RAM or mass memory) and allowing a use of resources suited to the application they must

support.

Further advantages are the possibility of

increasing resources the instant they are needed

(e.g., due to a sudden increase in the workload

generated by a traffic burst) and being able to

reduce them the instant they are no longer

needed, ensuring cost savings.

This "abstraction" of cloud computing also

makes it possible not to have to keep the physical

machines directly on site, reducing the times in

which the application is offline due to failures of

the infrastructure or of the machines
themselves.
The Module allows configuring and using a private Cloud Computing system within the Laboratory.
It consists of a Server equipped with all the necessary software components:
• Preconfigured physical server
• Physical hardware
• Ubuntu Operating System
• Apache CloudStack cloud computing platform and its software requirements
• Open Office, MySQL Database
The resources of this server can be accessed autonomously from the laboratory workstations, using a
browser (e.g., Google Chrome) to connect to the Apache CloudStack web interface.
There is also a command prompt with SSH connection capability: Putty for Windows environment.
This solution of implementing a physical Server inside the Laboratory, instead of using Servers available
online on the Internet with their Cloud Computing services, certainly has positive aspects both in terms of
performance and, in the medium and long term, in terms of costs avoiding the burden of periodic payment

for the service.DL NGL

CloudStack allows configuring Virtual Machines, which reside on the Server, but which are used by Remote

Users. For each machine you can set resources such as: number of cores, memory, disk space, etc.

The activity of all Virtual Machines is controlled on the server, in real time, using the appropriate CloudStack

tools.

Once users of the system have connected to one of the Virtual Machines, they can work on them as if they

were computers on their workstation. It works with the Ubuntu Operating System and with all its individual

productivity tools: Editor, Spreadsheet, database, etc.

Educational experience

- Introduction to Cloud Computing €
- Types: IaaS, PaaS, SaaS, XaaS €
- Cloud Services €
- Storage, security, analysis services €
- Setting up virtual machines €
- Using virtual machines €
- Examples and applications DL NGL €

NEXT GENERATION LABS

The DL NGL-CLOUD module can be

integrated in the NEXT GENERATION LAB -

DL NGL laboratory through the minimum

purchase of the following modules:

• **Teacher Station - DL NGL-BASE**

Necessary for the proper functioning of

the laboratory. Quantity: 1.

• **Student Station - DL NGL-STUDENT**

To be multiplied by the number of

"student stations" to be created.

DL NGL

DL NGL-CIMSIM

Module for the study of a conveyor beltDL NGL

The design and construction of electronic circuits to solve practical problems is an essential technique in the

field of electronic engineering and computer engineering.

With this board system, students can study the properties of a conveyor belt used in industrial environments.

Sensors and actuators are included for the development of a complete course on the main characteristics of

conveying systems and their applications.
The system is equipped with SCADA software for studying automation and industry 4.0 concepts and can be
combined with the other simulators of the family to simulate a simplified industrial 4.0 factory.
The system for studying a conveyor belt consists of two main elements:
• A kit of boards for studying the hardware characteristics and control techniques of a conveyor belt. Sub
boards include all the components, sensors, and actuators needed to understand and manage the
operation of a conveyor belt.
• A real hardware simulator of a conveyor belt used in industrial environments. Through this simulator,
the student will be able to learn how to operate and control a production line through the use of a PLC
and an open-source microcontroller. Its structure allows the connection of the components included in
the board kit, making them compatible with each other.
The integration of the belt conveyor system in an industrial process is possible through a **SCADA** software,
which allows a study on the concept of automation and Industry 4.0.

With the card and the respective simulator, the DL NGL interacts through a gateway software allowing the

passage of information between devices that use different communication protocols, guaranteeing the

compatibility between them by their interoperability and by providing a common interface for their

communication. The end user can monitor, interact, acquire, and analyse the data generated by interactions

to manage and optimize the entire industrial process. **DL NGL**

Description of the System:

KIT OF BOARDS

EDUCATIONAL EXPERIENCES

Kit composed of sub-boards for the preparatory

study of the different elements that make up a

system of conveyor belts. The sub-boards can

interact with each other through a dedicated

motherboard, allowing the student to perform

interactive practices on different topics related to

automation such as:

• Control of an LCD display via a microcontroller.

• Detection of an object using an infrared sensor.

• Monitoring of an RGB sensor.

• Control of a DC motor through a power driver.

• Control of a stepper motor.

• Action control and interlock function via a push button pad.

• Writing on a seven-segment display.

CIRCUIT BLOCKS

• Motherboard

• LCD display sub-board

• DC motor driver sub-board

• DC motor sub-board

• Inputs sub-board

• Seven-segment display sub-board

• Stepper motor with driver sub-board

• IRD sensor sub-board

• RGB sensorsub-board

• Microcontrollersub-board

DL NGL

HARDWARE SIMULATOR

EDUCATIONAL EXPERIENCE

This system is mainly used to teach, demonstrate and experiment with different methods of controlling a conveyor belt.

The student will improve the skills necessary for the HW designing and SW programming of an electromechanical system.

A real PLC (supplied with the trainer) controls the sequential operation of the system, as in real

automated processes, allowing the development,	
implementation and optimization of an application	
in the industrial field:	
• Control of a conveyor belt through a pushbutton	
panel.	
•	
Use of a PLC to control the movement of the	
conveyor belt.	
•	
Monitoring and identification of a processed	
part on the conveyor belt.	
• Tracking of the position of a part placed on the	
conveyor belt.	
•	
Identification and check of the color of a part.	
•	
Identification of a defective part and placing it in	
the correct position at the end of the line.	
The system interfaces with the SCADA software for	
monitoring and control.	
TECHNICAL CHARACTERISTICS	
• Power supply: 90V-230V ±10%, 50/60Hz	€
• DC motor that drives the belt:	€
o Speed: 10 rpm	
o	
Rated voltage: 12 Vdc	
• Linear actuator of the stepper motor:	€
o	
Rated voltage: 12 Vdc	
• Servo motor:	€
o Rated voltage: 5 Vdc	
• Control panel:	€
o	
Motor drivers	
o	
Inputs and outputs of sensors and	

actuators accessible via 2 mm	
connectors.	
o Slot for inserting the system boards.	
o Compatible with Arduino UNO boards:	
o ATMEGA328 processor	
o 32KB flash memory	
o 1KB EEPROM memory	
o 2KB SRAM memory	
o 23 generic I/O ports	
• IR position sensor	€
• RGB sensor	€
• RFID detector **DL NGL**	€
ACCESSORY INCLUDED:	
NECESSARY ACCESSORY:	
DL 2555ALG	
DC power supply	
• ± 5 Vdc, 1 A	€
• ±15 Vdc, 1 A	€
DL 2110AM	
Programmable Logic Controller 12/10	
Type of module: frame or bench type	
PLC inputs:	
• 8 digital inputs	€
• 4 digital/analogue inputs	€
PLC outputs:	
• 8 relay outputs	€
• 2 analogue outputs (V / I selectable outputs)	€
Two 0-10 V outputs are adjustable through	
potentiometer.	
12 digital level switches	
8 LED for the visualization of the output states	
Output in 24 V	
DC	
fixed voltage	

Programmable via USB port

DL NGL

NEXT

GENERATION

LABS

DL NGL-CYBER

Module for the study of cybersecurity

DL NGL

The 'Cybersecurity' module has been developed for the study of the problems relating to the security of

devices, networks and systems.

It addresses the various issues starting from a complete analysis of the OSI model, providing the student with

a holistic view of security which he can then apply to the various areas in which he will operate.

In fact, the OSI model is an essential tool, not only for understanding how a network works, but also for
understanding where cyber threats arise and what steps to take to eliminate them.
Data within networks travel through various layers represented by the OSI Model and, at each layer, there
are different types of vulnerabilities.
To comprehensively address network vulnerability issues, action must be taken at every level.
Security issues at various levels include:
protection against unwanted physical access,
ARP spoofing, unwanted data access, capture of
personal information such as identifiers and
passwords, worms and viruses.
The security tools and solutions used include:
physical access restriction, private Virtual LAN,
Firewalls, information encryption, network user
authentication, anti-virus tools.
The Module consists of a series of software tools,
which integrate with the DL WORKSPACE, which
allow the study and experimentation at the
different levels of the OSI model on security
issues: Servers, Clients, Packet Analyzers,
Network Analyzers, etc.

Practical exercises are included, such as the one that simulates a 'man in the middle' type attack, where a

hacker places himself between a Client and a Server and, capturing the communication packets that pass on

the network, is able to steal sensitive information such as identifiers and passwords.

The solution to this type of attack is to encrypt the data with a

secret key before sending it over the network. **DL**

NGL

The DL WORKSPACE contains the encryption tools for

performing these kinds of hands-on experiences.

Other fundamental experiences for learning

Cybersecurity issues are those relating to the Firewalls

contained in the Routers of home computer networks,

which protect home networks from unwanted access.

Firewalls are hardware and software devices designed

to protect our private networks from intrusion by

strangers while connected to the Internet.

It is, therefore, necessary to pay the utmost attention to

the configuration of the Router: in the event that some

'chink' is left open, a hacker could exploit it to access

devices and personal data.

The Module contains Routers to perform Firewall

configuration exercises to optimize the security level of
your home networks.

NEXT GENERATION LABS

The DL NGL-CYBER module can be

integrated in the NEXT GENERATION LAB -

DL NGL laboratory through the minimum

purchase of the following modules:

• **Teacher Station - DL NGL-BASE**

Necessary for the proper functioning

of the laboratory. Quantity: 1.

• **Student Station - DL NGL-STUDENT**

To be multiplied by the number of
"student stations" to be created.

Educational experience

• Introduction to cybersecurity

• OSI model and security issues

• Physical level security

• Data Link level security (ARP spoofing,
VLAN)

•
Network level Security (VPN)

•
Transport level security (Firewall)

•

Session level security (encryption and
authentication)

•
Presentation and Application level

security (antivirus).

DL NGL

NEXT

GENERATION

LABS

DL NGL-DATA

Module for the study of big data

DL NGL

The 'Big Data' module deals with the study of the processing and analysis of large amounts of data in the

context of Data Science.

Big Data differs from traditional data collections in several characteristics: the amount of data, the fact that

data is generally unstructured because it comes from different sources and forms and, in the case of real

time streaming, the speed with which the data arrives.
New technologies have been introduced in Data Science that deal with the management and analysis of large
data, overcoming the limitations of traditional data management systems such as relational DBMS (Database
Management System).
The ‘Big Data’ module uses Apache Spark, an open-source framework that supports in-memory parallel
computing to optimize the performance of applications that analyse Big Data.
It is used by a great many organizations around the world, including IBM, NASA, Samsung and Yahoo!, and
its use is constantly expanding.
Within the Module, simple applications will be
developed using the Python programming
language.
The 'Big Data' module addresses the main issues
of big data processing with an informative
approach and with practical exercises that make
learning more effective.
The data that is analysed can be of different types:
structured, semi-structured or unstructured. The

most common structures in Apache Spark are:

DataFrame, dataset and RDD (Resilient

Distributed Dataset).

The analysis of Big Data often has the objective of

making predictions or deriving any strategies for

users based on the available data.

For advanced analysis and Machine Learning-type processing, the Spark MLib library is used, which allows

performing preliminary data analyses, implementing regression and classification models, making

predictions, but also clustering.

In fact, it provides various algorithms, such as those for linear regression, the K-means method, the random

forests, etc.

The Module will examine different processing techniques with different purposes, for example, Supervised

Learning in which, starting from historical data, we will try to train a model to predict future data through an

iterative optimization algorithm. **DL NGL**

Or, the Unsupervised Learning, where you try to find

patterns or discover the underlying structure in a set

of data.

This methodology is particularly indicated in the search for anomalies, but it is also very useful in marketing, to carry out segmentation and, therefore, identify groups that are as homogeneous internally and heterogeneous as possible.

Finally, the processing of data represented by graphs, graph operators, graph algorithms, graph builders and other techniques are examined. A graph is a set of nodes (or vertices) connected to each other through arcs and can be used to represent, for example, the friendship network in a social network where the nodes are people while the arcs represent friendships.

Spark's GraphX library provides algorithms for measuring the importance of a node, the presence of any hubs, calculating connected components, calculating triangles, etc.

Most of the practical exercises will be carried out on real data taken from the site www.kaggle.com, which contains datasets accessible to all and of different formats.

NEXT GENERATION LABS

The DL NGL-DATA module can be integrated in the NEXT GENERATION LAB -

DL NGL laboratory through the minimum

purchase of the following modules:

• **Teacher Station - DL NGL-BASE**

Necessary for the proper functioning

of the laboratory. Quantity: 1.

• **Student Station - DL NGL-STUDENT**

To be multiplied by the number of

"student stations" to be created.

Educational experience

• Introduction to Big Data

• Concepts of database and statistics

• Architecture of a Big Data analysis platform

• Parallel data processing

• Use of Data Frames

•

SQL queries on structured data

•

Models of advanced analysis and Machine

Learning

•

Processing of data represented by graphs

•

Examples and applications

DL NGL

NEXT

GENERATION

LABS

DL NGL-IOT

Module for the study of the Internet of ThingsDL NGL

The term "Internet of Things" identifies a system in which not only people are able to connect to a Global

Network, but also the most common objects.

These objects can be seen and controlled both by other

objects and by network users.

There is no limitation to the type of object that can be

connected, thus providing the Internet of Things with

an unlimited space of applications: industry, home

automation, medicine, etc.

The 'IoT' Module adds to the Basic Module the devices and tools for the study and learning of all topics related

to the Internet of Things.

With this module you can acquire skills on all issues related to the IoT world:
• Characteristics and performance of the devices to be connected: sensors, actuators, etc.
• Communication technologies: protocols, networks, etc.
• Information technologies:server, database, client, etc.
• Analysis of performance, safety, etc. of the system.
The Module consists of devices and tools to set up a complete IoT system, where to carry out all the exercises
and experiments:
• **DevIoT Unit,** with sensors, actuators and connection interfaces to wired and wireless networks. It is
supplied with Firmware for immediate use, but it is also programmable via the Arduino development
platform to allow users to develop customized applications.
• **IoT Server and Client** (with MQTT protocol).
• **Service tools**for testing and functional analysis: protocol analysers, Wi-Fi analysers, network traffic meters,
etc.
The figure shows the laboratory network and how the devices of the IoT Module find their space within it to
provide a complete system that represents a real IoT application.

The IoT Module can be integrated with the miniSim series Simulators that allow studying different IoT
applications:
• Energy
• Agriculture
• Chemistry
• Biomedical
• Manufacturing
• Automotive
Through the tools made available, they reproduce complete IoT systems in a single workstation, in an 'open'
form, where the student can therefore interact independently with the different parts of the system in
learning operations, at any level. **DL NGL**
Devices and tools are described below.
• **DevIoT Unit:**
o Rechargeable battery powered via USB
(5V)
o Microcontroller STM32F103
o Display LCD 128x64, 5-key keyboard
o USB interface
o Compatibility with Arduino development
platform
o LAN Ethernet 100Mb/s interface
o Wi-Fi network interface
o 4 interfaces for analogue sensors
o 3 interfaces for digital sensors
o 2 interfaces for actuators
• **Sensors and actuators to be connected to the DevIoT Unit:**

o Sensors:
◌
PT100 temperature analogue sensor
◌
Pressure analogue sensor
◌
Force analogue sensor
◌
Brightness digital sensor
◌
Ultrasonic distance digital sensor
◌ Acceleration digital sensor
◌
ON-OFF inputssensor
◌
Heart rate sensor
o Actuators:
◌ DC motor
◌ Step motor
◌ ON-OFF outputs
MQTT (IoT) Broker and Client and Service Tools
An IoT application is basically a 'distributed' application. where the various components of the system
(sensors, servers, clients, actuators, etc.), located in different places, communicate with each other through
the Internet. Reproposing distributed systems of this type at an educational level, where the student, in order

to be able to learn, must see inside the system how information passes from one component to another, is

impossible using directly Servers available online on the Internet with their hosting services. For this reason,

the IoT Module is equipped with software to implement IoT Server (Broker) and Client, integrated in the DL

WORKSPACE environment, and, therefore, usable on all workstations.

All this allows each Student, with the resources of his own workstation, to set up a complete IoT System and

to experiment on it at any level. He is, therefore, enabled to learn the various problems that underlie systems

of this type, working autonomously on his own workstation and proceeding at his own learning speed. **DL NGL**

MQTT Broker

DL WORKSPACE provides an MQTT Broker for all

exercises related to the IoT. This is the

indispensable tool for connecting the various

devices of the system to each other. The Broker

is equipped with a Database where the devices

and the parameter values that they publish on
the network are stored. The Broker Console
displays all the information that passes through
the Server, thus allowing the student to analyse in detail the operation of the system.
MQTT Client
The DL WORKSPACE also integrates an MQTT
Client, widely used in carrying out the
experiments. The Client allows you to connect to
a Broker and manually set all the commands of
the MQTT Protocol that allow communication. In
this way, the student can analyse in detail all the
characteristics of the protocol which underlies the IoT.
Among other service tools that are used in the exercises we have:
The **Wi-Fi Network Analyzer**, which allows detecting
the networks present in the area of interest and
checking all the parameters, including the level of the
signal, the frequencies and the channels used.
The **Network Speed Meter**, which allows checking the
performance of a network in terms of data transfer

speed.**DL NGL**

The **Network Packet Analyzer** (or Packet Sniffer), a software

tool that allows capturing and analysing packets traveling on

a network. This tool is commonly used in network testing

operations, but can also be used by hackers to capture

'sensitive' user data.

All the above tools make the IoT Module an effective tool for studying the Internet of Things and its applications.

The following notes, taken directly from an exercise in the manual, are an example.

Suppose we want to study the functioning of an IoT system

where a 'switch' object (placed anywhere in the world)

controls a 'lamp' object (placed anywhere else in the world)

via the Internet of Things.

The 'real system' that implements the above system, with its components, is shown in the figure.

Each of the two devices (switch and lamp) must be

equipped with a Wi-Fi module that transmits or receives

information from an MQTT server located anywhere on the

Internet.

The "switch module" publishes its On/Off status on the

server via the topic 'OnOff'. The "lamp module" subscribes

to the switch's 'OnOff' topic on the MQTT server and

receives its status every time it changes. **DL NGL**

The previous 'real system' can be implemented, within the IoT Module of the DL NGL Laboratory, using a single workstation. The student uses:

- a DIGI digital sensor
- a DIGO on/off actuator
- a DevIoT Unit, LAN o Wi-Fi connected to its own PC
- the MQTT Server/Broker on the PC

All the experiments on the system are widely documented in the DL WORKSPACE.

Use with the Arduino development platform

The DevIoT Unit is equipped with a Firmware that allows its use in all the applications.

This firmware provides to:

- the automatic detection of connected sensors and transducers,
- the experimentation of the operation of each of them,
- the connection with an MQTT Broker for the applications related to the Internet of Things,
- the management of the miniSim with all the exercises,
- the connection via USB to the computer for parameter setting and supervision operations,
- the keyboard, display and battery management.

The STM32F103 Microcontroller can also be programmed via the Arduino Platform, using a serial interface

(UART) of the microcontroller and a Serial-USB adapter (supplied) for connection to the computer.

The figure shows the connection of the serial adapter for

developing applications with Arduino.

DL NGL

C++ libraries are provided for managing all board resources:

• 128x64 graphic LCD display,

• SPI interface with external digital sensors,

• Ethernet interface,

• Wi-Fi interface,

• etc.

Simple examples of the use of each of the board's functions are also reported in the documentation.

‘Basic’ didactic program

• Introduction to IoT

o Definition of an IoT system.

o Fields of application: industrial, safety, health, home automation, etc.

o Structure of an IoT system and its components: sensors, actuators, networks, protocols, etc.

o Server and client: user interfaces.

o Future issues and developments.

• Sensors, transducers and actuators

o Sensors for acquiring the physical quantities to be controlled.

o Actuators for commanding and regulating physical quantities.
o Microprocessor acquisition and control unit.
o The problems of remote control and supervision.
• Structure of an IoT network
o The Client-Server structure.
o The MQTT protocol: message publishing and subscription.
o MQTT Client and Server.
• Application examples
o Remote sensing of environmental parameters: temperature, humidity and pressure.
o Safety systems: distance detection of objects with ultrasound system.
o Remote control of industrial devices: motors, actuators, etc.
o Home automation: command and control devices.
o Telemedicine: remote detection of physiological parameters.
‘Advanced’ didactic program
• Introduction to IoT
o Definition of an IoT system.
o Fields of application: industrial, safety, health, home automation, etc.
o Structure of an IoT system and its components: sensors, actuators, networks, protocols, etc.
o Server and client: user interfaces.
o Future issues and developments.
• Control and supervision of industrial processes.
o Sensors for acquiring the physical quantities to be controlled.
o Actuators for commanding and regulating physical quantities.

o Microprocessor acquisition and control unit.
o Firmware development on Arduino platform.
o Wired and wireless networking of devices.
o The problems of remote control and supervision. DL NGL
• Structure of an IoT networks, communication devices and protocols
o The structure of the Internet network. o Network connection devices: routers, switches, access
points, etc.
o Communication protocols: the OSI Model.
o MQTT protocol: message publishing and subscription.
o HTTP protocol. o Security issues.
• Server, database and Client
o Structure of an MQTT Broker.
o Structure of an HTTP Server.
o Database SQLite.
o Development of Web Client applications: languages HTML, JavaScript.
• Application examples
o Remote sensing of environmental parameters: temperature, humidity and pressure.
o Safety systems: distance detection of objects with ultrasound system.

o Remote control of industrial devices: motors, actuators, etc.

o Home automation: command and control devices.

o Telemedicine: remote detection of physiological parameters.

NEXT GENERATION LABS

The DL NGL-IOT module can be integrated

in the DL NGL - NEXT GENERATION LAB
laboratory
through the minimum

purchase of the following modules:

• **Teacher Station - DL NGL-BASE**
Necessary for the proper
functioning of the laboratory.

Quantity: 1.

• **Student Station - DL NGL-STUDENT**
To be multiplied by the number of
"student stations" to be created.

Communication: Modbus RTU RS485

On Fri, Aug 1, 2025 at 3:04 PM TSHINGOMBEKB TSHITADI <tshingombekb@gmail.com> wrote:

AUTOTRONICS

DE LORENZO S.p.A. V.le Romagna 20 – 20089 ROZZANO (MI) Italy – Tel. ++ 39 02 8254551

Fax ++39 02 8255181- E-mail: info@delorenzo.it- sales@delorenzo.it

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IGNITION SYSTEM TRAINING PANEL
DL DM91

LEARNING EXPERIENCE

This demonstration panel represents the structure and operation of the engine ignition system based on real components of six ignition systems, including the mechanically timed ignition system, hall effect electronic ignition system, magnetic trigger electronic ignition system, optical trigger electronic ignition system, distributorless ignition system, (Each ignition coil services two spark plug), distributorless ignition system (Coil-On-Plug). The device applies to theoretical teaching and maintenance training of the ignition system for secondary vocational skill schools.

GENERAL CHARACTERISTICS

- €

Dim. mm (HxLxW) : 1900x2400x700

- €

Weight approx. kg 200

- €

Input power supply: AC 220V ± 10% 50Hz

- €

Operating voltage: 12V DC	
•	€
Operating functioning temperature: -40℃ to +50℃	
MAIN CHARACTERISTICS	
The didactic system shows: 6 real-life and operable	
ignition systems. These are used to illustrate the	
structure and operating process of the ignition	
system.	
Such system includes:	
• mechanically timed ignition system,	€
• hall effect electronic ignition system,	€
• magnetic trigger electronic ignition system,	€
• optical trigger electronic ignition system,	€
• distributorless ignition system (Each ignition coil	€
services two spark plugs),	

- distributorless ignition system(Coil-On-Plug). €

OTHER CHARACTERISTICS

a) The trainer is made of advanced aluminum

plastic plate with characteristics of not less

than 4mm thick. The plate is corrosion

resistant, impact resistant, pollution resistant,

fireproof, and moisture proof. The panel

surface is processed by special craft and

spraying primer. The circuit diagrams are

painted with never fade colour and the boards

are coated with varnish. The trainees can learn

AUTOTRONICS - DEMONSTRATORS

AUTOTRONICS

DE LORENZO S.p.A. V.le Romagna 20 – 20089 ROZZANO (MI) Italy – Tel. ++ 39 02 8254551

Fax ++39 02 8255181- E-mail: info@delorenzo.it- sales@delorenzo.it

We reserve the right to modify our products without any notifications.

ACCESSORIES

Suggested instruments for best practice:

-

Digital Multimeter (not included)

-

Automotive Oscilloscope (not included)
and analyze the working principle of the
control system by looking and analysing the
diagram and the real-life components.
b) The training panel has installed detection
terminals to identify electric signals, such as
resistance, voltage, current, and frequency, of
circuit components of the ignition system.
c) The training base frame is made of steel and
the surface is paint-coated. Pivoting wheels
are mounted.
d) The didactic panel does not use accumulators
or battery and it does not require any
charging. It can be connected to a 220V AC
voltage which changes to a 12V DC voltage
through the internal circuit. The 12V DC
voltage protects the training panel against
short circuit.

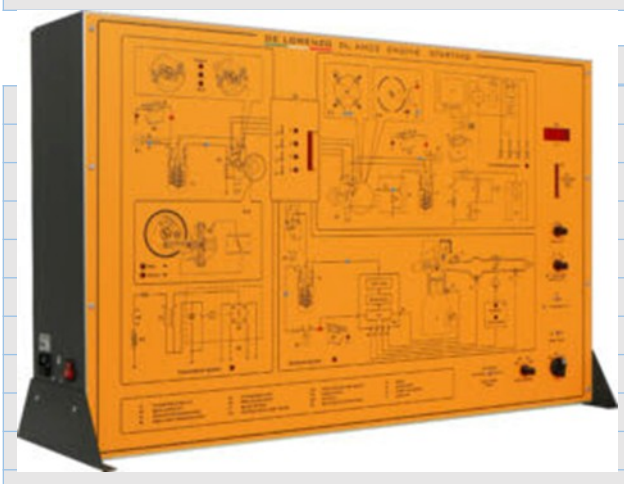
e) Equipped with intelligent fault setting system,

include fault setting and troubleshooting.

AUTOTRONICS - DEMONSTRATO

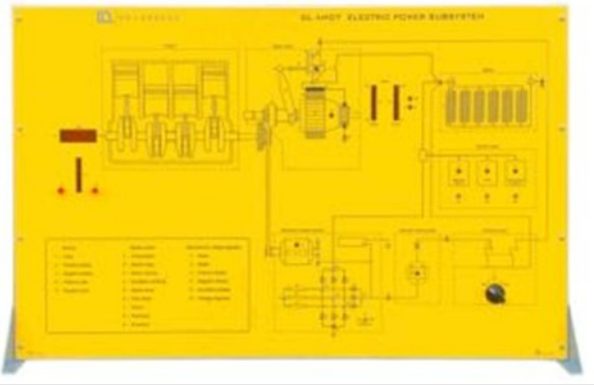
IGNITION

Vehicle ignition systems has evolved significantly over the years to deliver improved, more reliable and more powerful performance. The purpose of the ignition system is to generate a very high voltage from the car’s 12V battery, and to send this to each sparkplug in turn, igniting the fuel-air mixture in the engine’s combustion chambers. The coil is the component that produces this high voltage. The widest application for spark ignition internal combustion engines is in petrol (gasoline) road vehicles: cars, four-by-four (SUVs), motorcycles, pickups, vans, trucks and buses. In some modern ignition systems, micro-electronics ensure the optimum ignition timing (the relationship between the exact time a plug is fired and the position of the piston in terms of degrees of crankshaft rotation) for all engine speeds and engine load conditions. For the ignition system field, De Lorenzo has designed some panels to simulate the behavior, with the help of a CAI software, such as the study of the starting techniques used in the Otto cycle engines (conventional, transistor and electronic ignition), the circuits and systems for the starting and the recharging, the techniques and the devices used in the starting systems for industrial vehicles and the electronics applied to ignition systems. Troubleshooting’s are provided in all of them. A demonstrator panel is also available for this category. It represents the operation of the engine ignition system based on real components of six ignition systems for teaching and maintenance training. It is equipped with intelligent fault setting and troubleshooting. They are recommended for professional institutes, vocational schools and technical colleges.



ENGINE STARTING

DL AM02

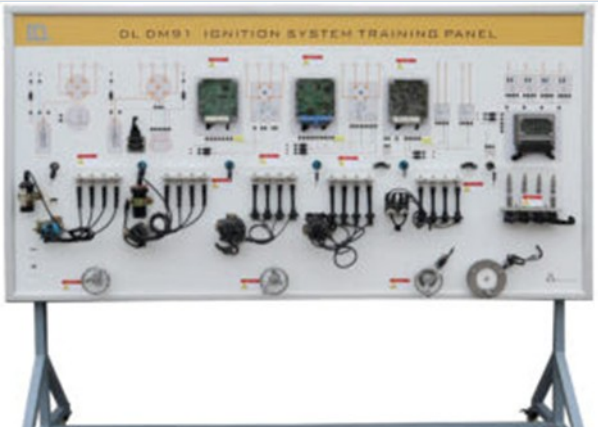


ELECTRIC POWER SUBSYSTEM

DL AM07

BIG VEHICLES STARTING

DL AM10



IGNITION SYSTEM TRAINING PANEL

DL DM91

IGNITION SYSTEM

DL AM13

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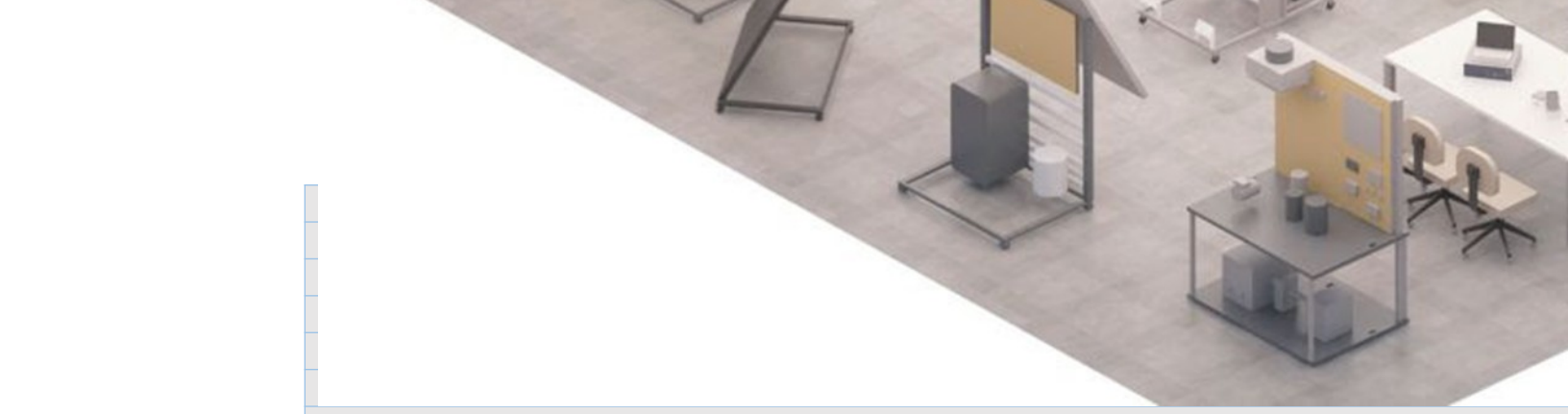
THERMOTRONICS (HVAC)

THERMOTRONICS (HVAC)

Thermotronics refers to the didactic systems intended for the study of thermotechnics that is, the equipment dedicated to the production, transmission and use of both domestic and industrial heat. Our Thermotronics laboratories study the topics related to cooling cycles, air conditioning, heating and sanitary water production systems. De Lorenzo is always at the forefront and has developed environments and solutions for training, equipment for students to be trained both theoretically and experimentally and to develop their professional skills inherent to thermotechnics. In each line of our products, it addresses study content from its study program, practices, and fault simulation systems. At De Lorenzo, we manufacture quality, flexible and educational systems for the development of skills of professionals in the 21st century.



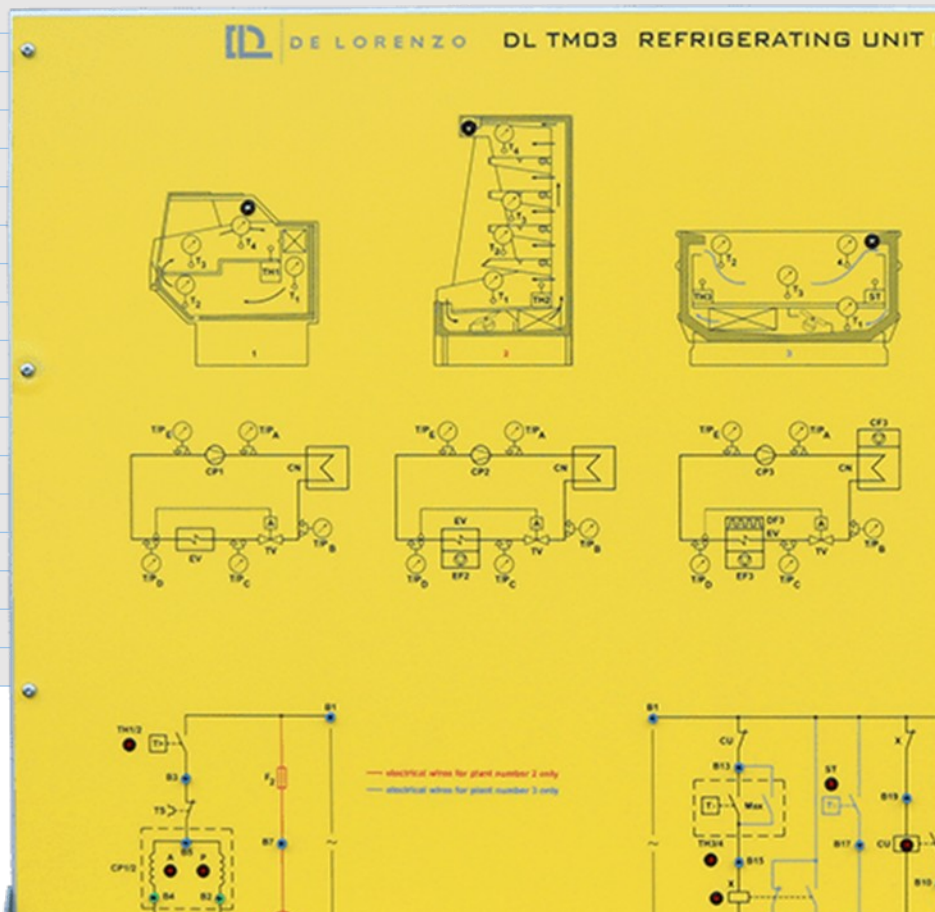
SOLUTION LABORATORY FOR THERMOTRONICS

Read more

AIR CONDITIONING

It is the process of treating the air conditioning of inhabited spaces; it consists in regulating the conditions in terms of temperature, (heating or cooling), humidity, cleaning (renovation, filtering) and the movement of air within the spaces of use. Both industrial and domestic systems that can be autonomous and centralized. Our systems for the study of air conditioning will allow students...

Read more



REFRIGERATION

Refrigeration is the process of preservation by physical treatment, which consists in maintaining a food or product in good temperature conditions (from -3ºC to 5ºC) to decrease or inactivate microorganisms in reproduction. Refrigeration has various applications, including medical, industrial and domestic. Our systems for the study of the refrigeration process will allow the student to acq...

Read more

HEATING AND SANITARY PLANTS

The sun is an extremely powerful energy source that often functions as storage. The heating system is the process of setting the temperature of an enclosed space in order to provide comfort to its occupants. Heating is the largest energy expenditure in the world, therefore, the reduction in the energy used for heating represents the most effective way to contribute to the resolution of environ...

Read more

HEAT TRANSFER

We call heat transfer, thermal transfer or heat transmission the physical phenomena from which heat spreads from one medium to another. This occurs when two systems of different temperatures come into contact, allowing the flow of energy from the point of highest concentration (in this case of higher temperature) to the point of lowest concentration, until reaching a thermal equilibrium, in whic...

SMART THERMO SYSTEM WITH EXPERIMENTAL MODULES

This smart system for the study of refrigeration and air conditioning integrates the most advanced components to control and optimize the systems in an efficient and sustainable way. It uses sensors, transducers, measurement devices and management and supervision software to monitor and collect real-time data on critical parameters such as pressure, humidity, flow and temperature.

Read more

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RS

THERMOTRONICS

MODULE FOR THE STUDY OF INDUSTRIAL AIR-CONDITIONING

DL TMACM-IAC

This trainer is designed for the complete and exhaustive study of thermodynamic

transformations the air undergoes when crossing a three-section central air-conditioning unit.

TECHNICAL FEATURES

The trainer includes the following components:

• Tabletop aluminium structure,	€
• Air conditioning unit including:	€
◆ duct with transparent walls,	€
◆ variable speed axial fan,	€
◆ cooling and dehumidification battery,	€
◆ humidifying section,	€
◆ heating battery,	€
◆ temperature and relative humidity sensors,	€
◆ anemometric sensor.	€
• Colour printed schematic diagram of the hydraulic circuit,	€
• Thermostatic expansion valve,	€
• Cocks for an easy connection (with the basic trainer **DL TMACM-RS**),	€
• Specific supervision software.	€
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TRAINING PROGRAM	
With this trainer, the students can perform the following practices:	
• The air psychrometric chart:	€
◆ determination of absolute humidity,	€
◆ enthalpy,	€
◆ specific volume,	€
◆ dew point.	€

• Transformations of the air due to variations of temperature and/or of relative humidity,	€
• Heating, humidification, cooling and dehumidification processes and heat balances,	€
• Using the air recirculation to save energy,	€
• Air quality and Air handling with mixing and filtration,	€
• Thermohygrometric comfort conditions of room occupants,	€
• System performances far from design conditions,	€
• Determining the airflow in ducts as speed varies,	€
• Fault insertion tests included (with the basic trainer **DL TMACM-RS**).	€

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THERMOTRONICS (HVAC)

SMART THERMO SYSTEM WITH EXPERIMENTAL MODULES

SMART THERMO SYSTEM WITH EXPERIMENTAL MODULES

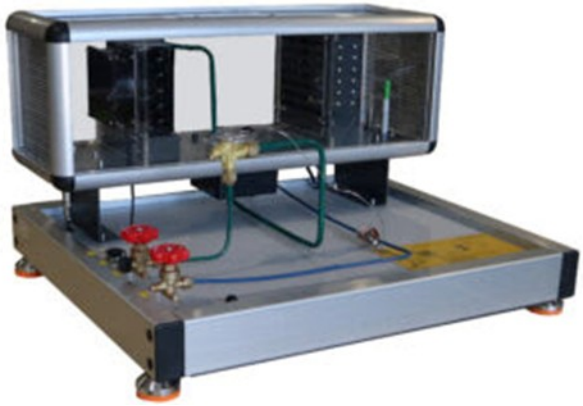
This smart system for the study of refrigeration and air conditioning integrates the most advanced components to control and optimize the systems in an efficient and sustainable way. It uses sensors, transducers, measurement devices and management and supervision software to monitor and collect real-time data on critical parameters such as pressure, humidity, flow and temperature.

SMART SYSTEM FOR THE STUDY OF REFRIGERATION AND AIR-CONDITIONING

DL TMACM-RS

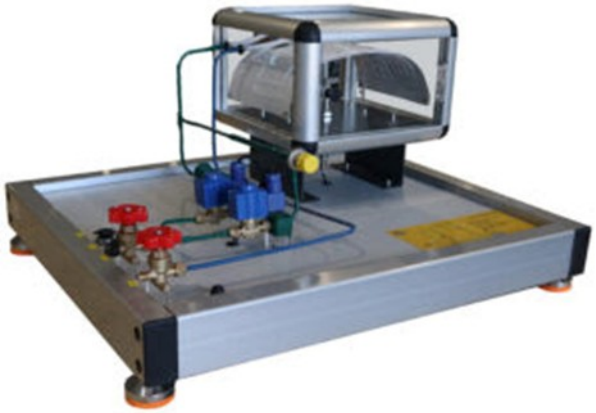
MODULE FOR THE STUDY OF DOMESTIC AIR-CONDITIONING

DL TMACM-AC



MODULE FOR THE STUDY OF INDUSTRIAL AIR-CONDITIONING

DL TMACM-IAC



MODULE FOR THE STUDY OF DOMESTIC REFRIGERATION

DL TMACM-CR

MODULE FOR THE STUDY OF INDUSTRIAL REFRIGERATION

DL TMACM-ICR

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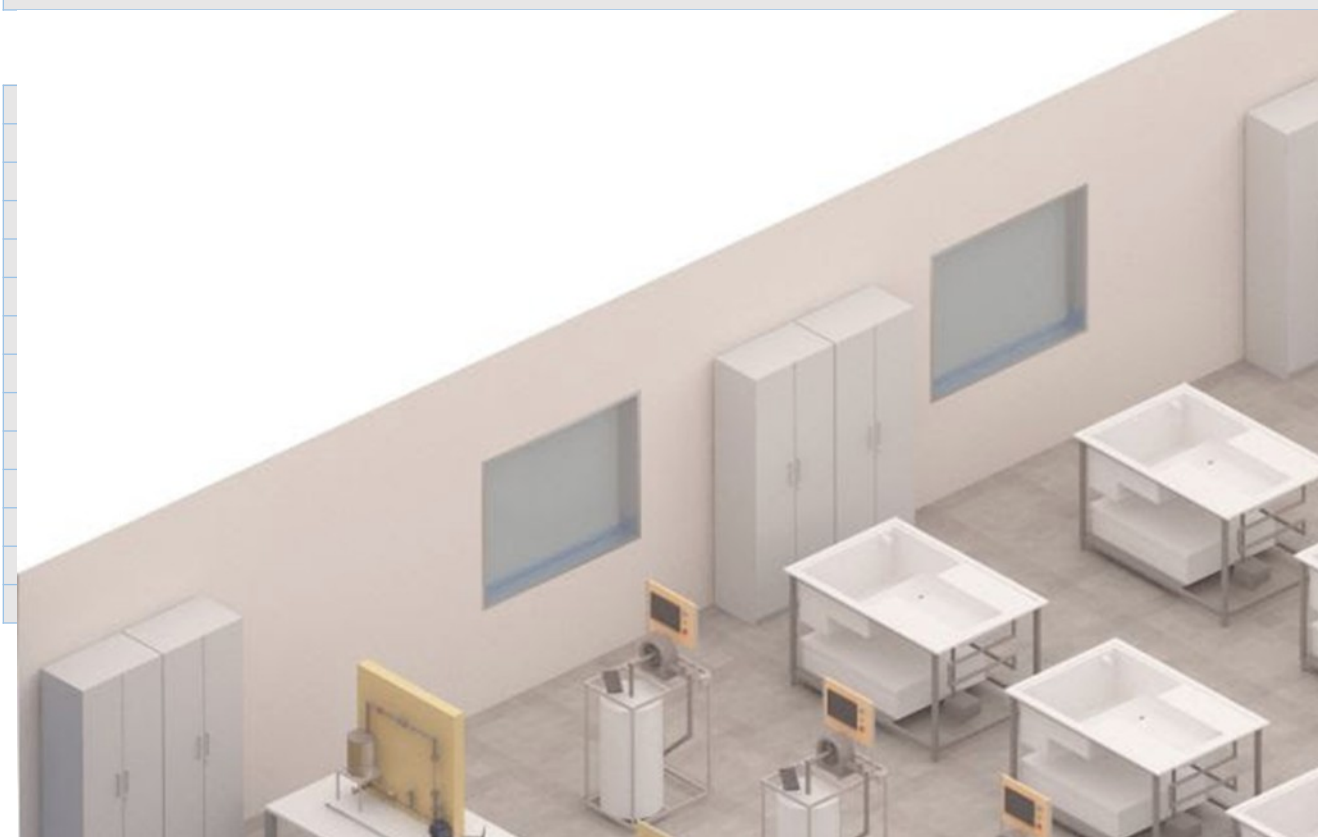
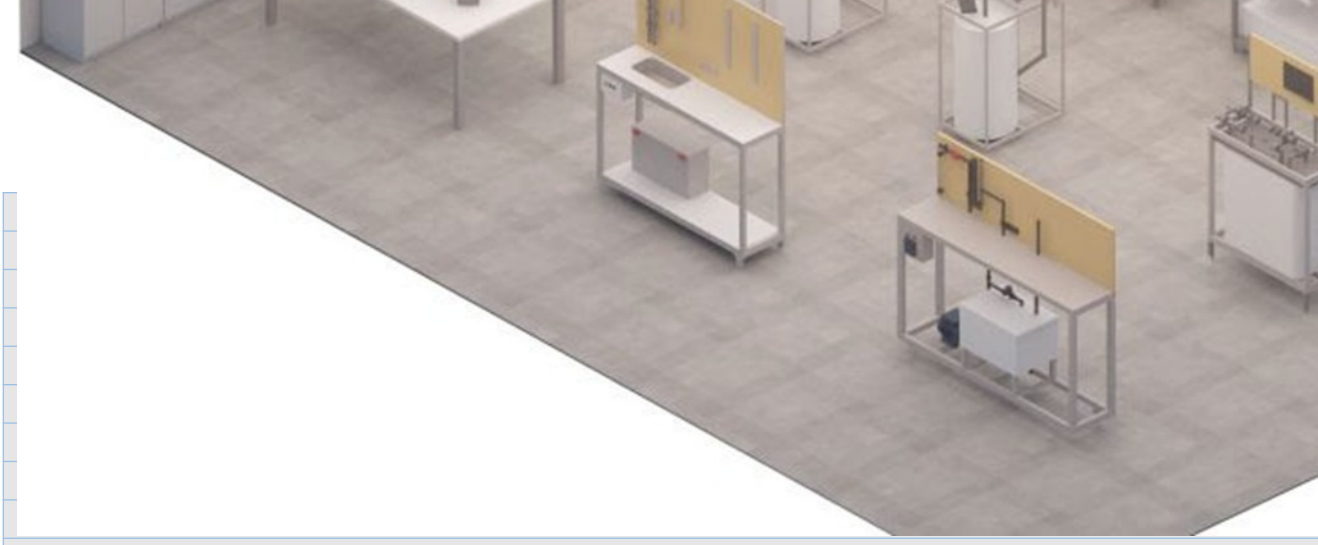
FLUID MECHANICS

Fluid Mechanics studies the laws of motion of fluids and their processes of interaction with solid bodies. Fluid Mechanics is a mixture of theory and experimentation derived from the research of hydraulic engineers, and also from the reflection of mathematicians and physicists, who address problems from an analytical approach. The fundamental characteristic of fluids is the so-called fluidity. A fluid changes shape continuously when subjected to stress, i.e. a fluid is not capable of withstanding a shear stress without moving during any interval of time. Some liquids will move more slowly than others, but under a shear stress they will always move. Fluid mechanics is fundamental in fields as diverse as aeronautics, chemical, civil and industrial engineering, meteorology, shipbuilding and oceanography. With our proposal of didactic systems De Lorenzo seeks to improve, enhance and develop cognitive and social processes in terms of professional competencies integrated by knowledge, skills and attitudes for a comprehensive training of the student in the area of Fluid Mechanics.





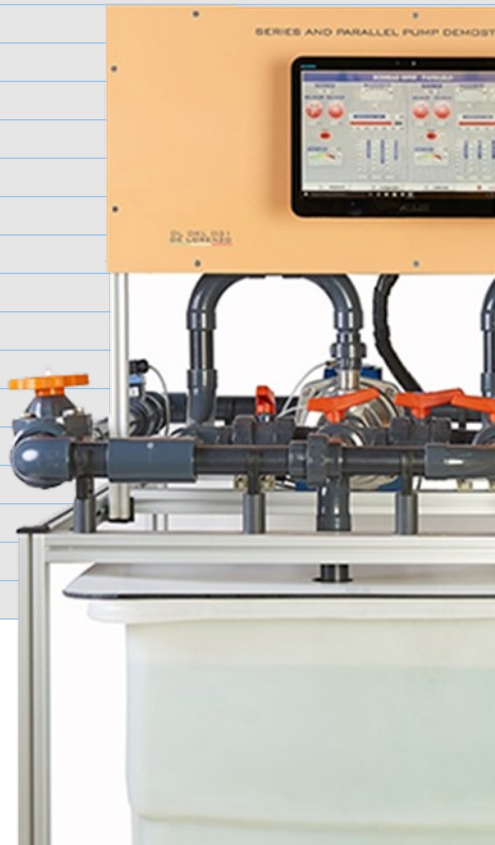
SOLUTION LABORATORY FOR FLUID MECHANICS

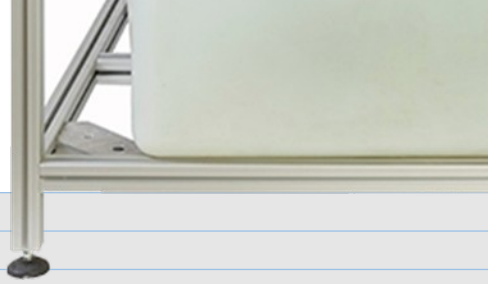
Read more

FUNDAMENTALS OF FLUID MECHANICS

Fluid mechanics is the study of the behavior of fluids under the action of applied forces. On a microscopic scale, matter, and in particular a fluid is composed of molecules at a certain average distance with empty space between them. These molecules are continuously moving and colliding with each other. An accurate analysis of any problem is based on the study of a molecule or group of molec...

Read more





HYDRAULIC MACHINES

A machine is an energy transformer. A machine absorbs energy of one kind and returns energy of another kind or of the same kind but transformed. The most practical application of Fluid Mechanics to engineering is machine design. Among them, the most numerous are those that supply energy to a fluid (pumps), although those that extract energy from it (turbines) are also important. Both types of...

Read more

AERODYNAMICS

Aerodynamics is the branch of fluid mechanics that deals with the movement of air and other gaseous fluids, and the forces that act on the bodies that move in those fluids. From a practical point of view of aerodynamics, we can mention the movement of an airplane through the air. The presence of an object in a gaseous fluid modifies the distribution of pressure and velocity of fluid particles...

Read more

HYDRAULICS, HYDROLOGY AND WATER TREATMENT

Water Treatment explores the techniques for sizing the precise elements for the operation of a hydraulic work, ways of verifying that an existing work is capable of transporting or evacuating the required flow rates, the study of the calculation and application of viable solutions, the study of the concepts on which hydraulics are based, as well as general concepts of environmental hydrology , th...

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FLUID MECHANICS

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COMPUTERIZED WATER HAMMER

DL DKL091H

This trainer has been designed for the visualization

and the study the phenomenon of water hammer.

It is possible to study the effects on a surge tank where

there is a decrease in the over pressure/ under

pressure generated by the water hammer.

The system is set for the observing and the testing of

the pressure increase produced by the variation of the

flow rate through a valve: it allows the observation of

positive and negative water hammer produced by the

sudden shut of a valve.

TRAINING OBJECTIVES

- Study and visualization of the pressure increase produced by the variation of the flow through a valve. €
- Study and visualization of the phenomenon of water hammer produced by the instantaneous closing of a valve. €
- Study and visualization of the phenomenon of water hammer by the unexpected shutdown of a pump €
- Study and display of the effects on a surge tank in the attenuation water hammer. €
- Determining the speed of sound through water a pipe. €
- Determining the head losses in a pipe. €

TECHNICAL DATA

PIPES:

- PVC pipe inner Ø= 28.4 mm, thickness= 1.8 mm and length= 3 m. €
- Copper pipe inner Ø= 26 mm, and thickness= 1 mm and length= 3 m. €

PRESSURE TRANSDUCERS

- 3x absolute pressure transducer 0-10 Bar. €
- 2x absolute pressure transducer 0-16 Bar. €

- 1x absolute pressure transducer 0-5 Bar. €

COMPUTERIZED SYSTEM

- Data acquisition module with USB connection €

VALVES

- 1" brass valve. €
- Ø32mm PVC ball valve. €
- NOTE: Valves are interchangeable between the 2 pipes. €

SURGE TANK

- 1.7 meters surge tank. €

Requirements:

- Power supply: 230V/50 Hz. €
- Compressed air line or air compressor for the quick closing valve. €

FLUID MECHANICS

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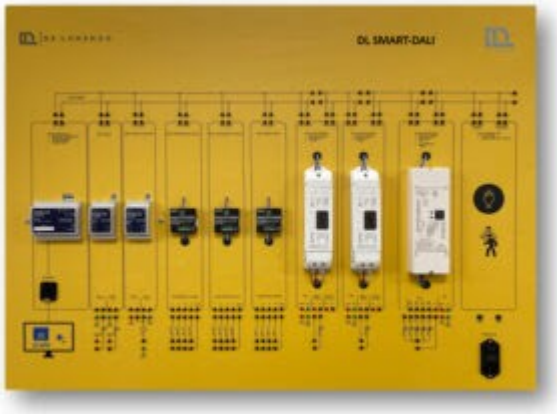
Necessary accessory:

DL DKL014 – Hydraulic bench

The basic hydraulic bench is a simple, mobile, self contained module that allows a supply of "hydraulic energy", i.e. an accurately controlled and measurable flow of water.

It includes two collecting tanks, a centrifugal pump, a flowmeter, a mobile frame work on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INDUSTRIAL PLANTS AND FOOD TECHNOLOGY

INDUSTRIAL PLANTS AND FOOD TECHNOLOGY

Petrochemical plants and machine trainers for the Oil&Gas industry.

INDUSTRIAL PLANTS

Industrial plant (physical or mechanical) refers to the necessary infrastructure used in operation and maintenance of a given facility. It is an area of general education that deals with technology and industry and should not be confused with “manufacturing plant” in the sense of “a factory”. It is an engineering discipline that includes engineering sciences and optimization of complex processes...

Read more

FOOD TECHNOLOGY

Food technology has evolved into an interdisciplinary area based on chemical engineering and food science dealing with the production processes that make foods. The demand for uniform and high quality food round the year, even at remote places from production center, has led to improved food processing technologies. Food industries are almost double the size of chemical industries and cover ma...

Read more

INDUSTRIAL CHEMISTRY

Industrial chemistry applies chemical knowledge to manufacture materials and products economically and with minimal impact to the environment. The industrial processes are used to convert raw into different products for a specific use. Electrochemistry studies the interaction between electrical energy and chemical change. In other words, Electrochemistry studies the changes and interrelationsh...

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EDUCATIONAL GREENHOUSES

With increasing world population, a comprehensive supply with high quality fresh organic food is more and more depending on efficient new growing methods. It will be critical to grow with high density, ecologically beneficial and close to the consumer. Beyond just science education, greenhouse building and design can provide an opportunity for students to understand and look at how everything...

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INDUSTRIAL PLANTS AND FOOD TECHNOLOGY

INDUSTRIAL PLANTS

INDUSTRIAL PLANTS

Industrial plant (physical or mechanical) refers to the necessary infrastructure used in operation and maintenance of a given facility. It is an area of general education that deals with technology and industry and should not be confused with “manufacturing plant” in the sense of “a factory”. It is an engineering discipline that includes engineering sciences and optimization of complex processes, systems or organizations. The main objective for people within this discipline is to improve efficiency, drive up effectiveness of manufacturing, quality control, and to reduce cost while making their products more attractive and marketable. Industrial engineering is concerned with the development, improvement, and implementation of integrated systems of people, money, knowledge, information, equipment, energy, materials, as well as analysis and synthesis. Therefore, industrial engineering is the branch of engineering that involves figuring out how to make or do things better. For this field, De Lorenzo has designed a wide range of industrial plants of modest size, recommended for professional institutes, vocational schools and technical colleges.

ABSORPTION DESORPTION PLANT

DL CH11

COMBINED CHEMICAL REACTOR

DL CH12

CONTINUOUS DISTILLATION

DL CH13

GAS PURIFICATION

DL CH14

LIQUID – LIQUID EXTRACTION

DL CH15

SOLID – LIQUID EXTRACTION

DL CH16

PLANT FOR THE STUDY OF EROSION-CORROSION

DL CH17

MILK STERILIZATION PILOT PLANT

DL CH21

CONTINUOUS DISTILLATION PILOT PLANT

DL CH22

PILOT PLANT FOR SOLID-LIQUID EXTRACTION INCLUDING SOLVENT RECOVERY UNIT

DL CH23

MULTIPURPOSE FREEZE-DRYING PILOT PLANT

DL CH24

ESSENTIAL OIL EXTRACTION PILOT PLANT

DL CH25

HEAT EXCHANGERS

DL PH02

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INDUSTRIAL PLANTS

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ESSENTIAL OIL EXTRACTION PILOT PLANT

DL CH25

The image is for reference only

DESCRIPTION

The Essential Oil Extraction Pilot Plant **DL CH25** has been designed to offer a complete, safe and efficient

solution for steam distillation processes, adapted to both educational environments and research and

development applications, built with high quality materials such as stainless steel AISI 304/306 and

borosilicate glass, this plant allows visualization of the extraction process, guaranteeing precision,

instruments such as pressure gauges, as well as an integrated safety system with emergency button, thanks

to its compact, modular and mobile design, ideal for demonstrating principles of chemical engineering, unit

operations and extraction technologies of natural products.

MAIN CHARACTERISTICS

- Stainless steel structure with wheels. €
- Borosilicate glass boiler. €
- Borosilicate glass collection tanks. €
- Bourdon spring pressure gauge. €
- PT-100 Temperature Sensors. €
- AISI 304 and 306 stainless steel connection lines and valves. €

• Pressure reducer for compressed air.	€
• Emergency push button.	€
• Variable area flowmeter. **INDUSTRIAL PLANTS**	€

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• Pneumatic valve for steam flow regulation to the boiler, made of stainless steel.	€
• Calibrated stainless steel diaphragm.	€
• Stainless steel electronic differential pressure transmitter.	€

ACCESSORIES INCLUDED

• Computer with Windows operating system.	€
• Data Acquisition Software.	€
• Computer cabinet and chair.	€
• Steam generator.	€
• Detailed practical manual.	€

The system is powered by single-phase voltage from the network.

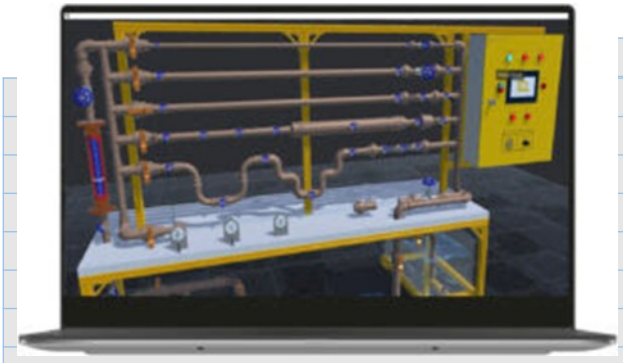
Home

SOFTWARE AND E-LEARNING

SOFTWARE AND E-LEARNING

SOFTWARE AND E-LEARNING

The main goal is that each student works individually in hands-on activities, without having to share equipment with other classmates. After performing several practices in the virtual environments, the student can book/schedule a session to use the real equipment, thus providing a more effective learning experience and optimizing the institution’s laboratory resources. De Lorenzo’s virtual reality e-learning solutions are “SMART”. Not only do they propose learning activities and experiments, providing contents and lessons, but also monitor the student’s progress by verifying automatically if the proposed tasks were successfully completed.

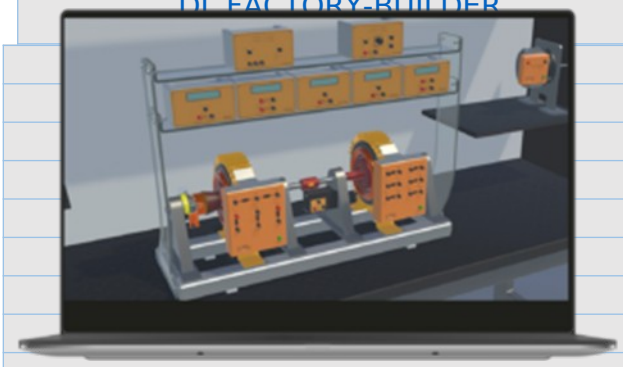


HYDRAULICS APPLICATIONS TRAINING

DL SMART-HYDRO

FACTORY DESIGN AND AUTOMATION

DL FACTORY-BUILDER



SMART SIMULATOR FOR ELECTRIC MACHINES TRAINING

DL OPENLAB-SSEM

ARTIFICIAL INTELLIGENCE COURSE

DL SMART–AI

CIVIL ELECTRICAL INSTALLATIONS VIRTUAL COURSE

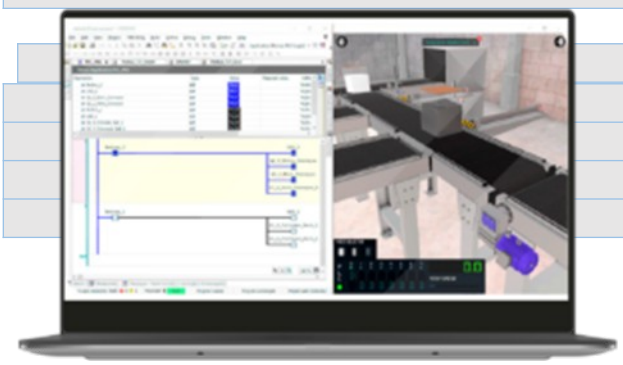
DL SMART-CIVIL

DYNAMIC CONTROL SYSTEMS COURSE

DL SMART-DCS

INDUSTRIAL ELECTRICAL INSTALLATIONS VIRTUAL COURSE

DL SMART-INDUSTRIAL



MACHINE AUTOMATION COURSE

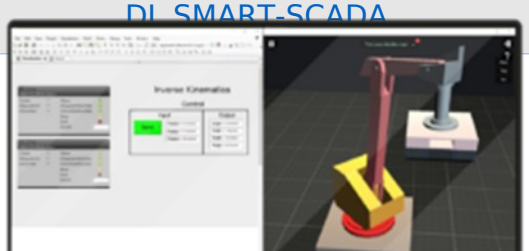
DL SMART-MA

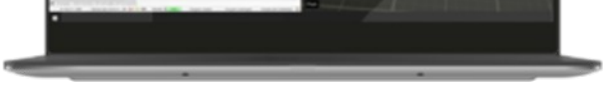
MACHINE VISION COURSE

DL SMART-MV

SCADA SYSTEMS DEVELOPMENT COURSE

DL SMART-SCADA





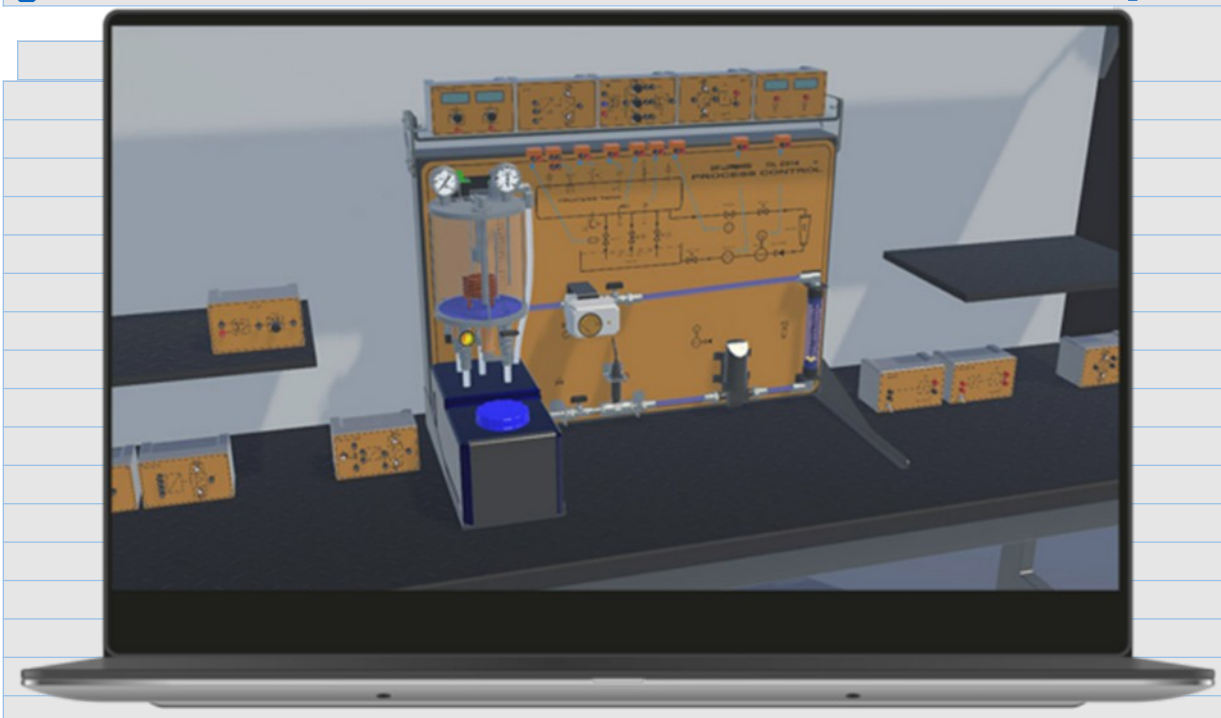
ROBOTICS COURSE

DL SMART-ROB

SMART SIMULATOR FOR PROCESS CONTROL TRAINING

SMART SIMULATOR FOR PROCESS CONTROL TRAINING

DL VPC-LAB4.0



The DL VPC-LAB 4.0 is a software that has been developed to teach process control techniques in a unique and effective way.

With this software, students can improve their individual experience on studying process control in practice.

Students will be able to carry out several experiments dealing with the following topics:

Control systems, open and closed loop system,

Sensors, transducers and actuators,

Input and power signal conditioning,

Level, flow, pressure, temperature,

Error, offset, calibration, response time, ON-OFF control, hysteresis, PID controller, Proportional control (P), Proportional-Integral control (PI), Proportional-Integral-Derivative control (PID).

This software will be able to reproduce the features and behaviours of the DE LORENZO Process Control Trainer – DL 2314.

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wheels, a set of valves and piping.

On Fri, Aug 1, 2025 at 2:50 PM TSHINGOMBEKB TSHITADI <tshingombekb@gmail.com> wrote:

TELECOMMUNICATIONS - ICT

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Communication Protocols: HDLC, SDLC, X.25, Frame Relay, ATM

DL TC72

Objectives:

Base training of an engineer for the installation and maintenance of Digital Telecommunications and

Internetworking systems.

This package provides the “background” for the next training on the Wide Area Networks and on Internet.

Educational Path:

The Educational Path of the Training Package covers the following subjects:

- **The communication architecture of the OSI model**

Introduction to the communication protocols, The OSI reference model, Format of the information, The OSI

model: Physical Level (level 1), Line Level (level 2), Network Level (level 3), Transfer Level (level 4), Session

Level (level 5), Presentation Level (level 6), Application Level (level 7).

- **HDLC/SDLC Protocols**

Introduction to the HDLC/SDLC Protocols, The structure of the HDLC frame, CONTROL field and type of frames,

The HDLC frames: Information, Supervisory, Unnumbered, Examples of HDLC session: NRM and ABM

connection.

- **Frame Relay network and protocol**

Introduction to the Frame Relay network and protocol, The Frame Relay and DLCI virtual circuits, The

permanent (PVC) and switched (SVC) virtual circuits, Control of the congestion: parameters DE, FECN, BECN,

Management of the throughput: parameters CIR, BC, BE, TC, LMI: Local Management Interface, Format of

the Frame Relay frames, Format of the LMI frames.

- **X.25 package switching network**

Characteristics and operating parameters, Format of the level 2 frame, Format of the level 3 package,

Addressing in the X.25 network.

- **Asynchronous Transfer Mode – ATM**

TELECOMMUNICATIONS - ICT

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Characteristics and operating parameters, Format of the ATM cell, Connections, Virtual Paths

and Channels, The ATM reference model.

Composed of:

TC72-MP: Communication Protocols

This module allows the simulation of the operation of the communication protocols.

It includes 2 LCD displays for the visualization of the frames and of the packages that the communication

devices exchange.

Furthermore, it includes 4 simulation boards with insertion system for the different protocols.

The following simulation boards are provided:

- HDLC Protocol, €
- ATM Architecture, €
- X.25 Network, €

- Frame Relay Protocol. €

Complete with all accessories and cables and Software package with theory, simulations and questions based

on Web technology.

Necessary accessory (not included):

- N.2 Personal Computer with Ethernet network interface and Windows Operating System. €

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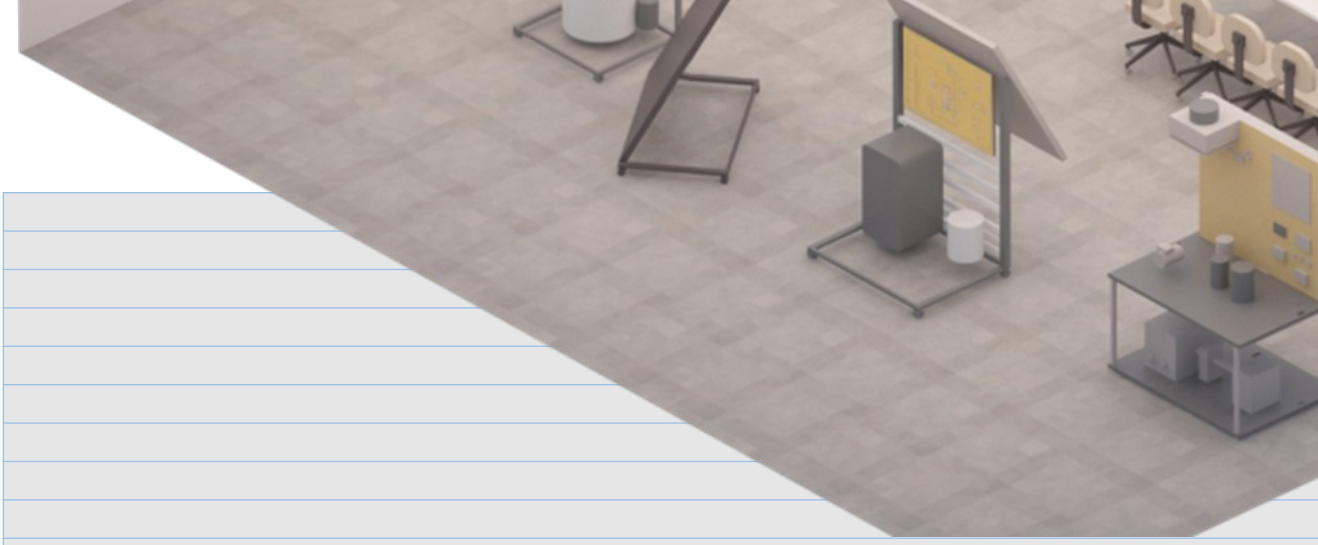
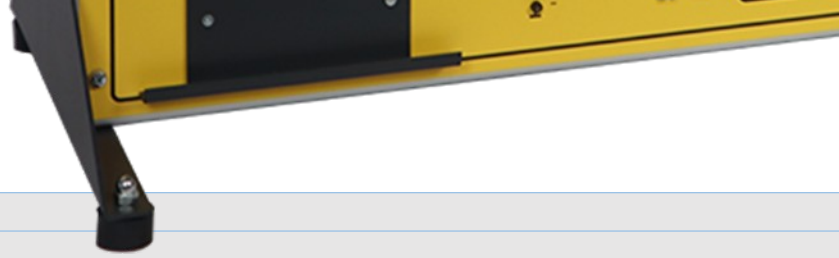
RENEWABLE ENERGIES

Renewable energies are the sources of energy based on the use of natural resources: sun, wind, water or plant or animal biomass. They are characterized by not using fossil fuels, but natural resources capable of unlimited renewal. One of their strengths is that they have a very low environmental impact, because in addition to not using finite resources, they do not generate pollutants. With our didactic systems we enable the technician, engineer and specialist in renewable energy, to develop professional skills in the formulation of renewable energy projects through energy diagnostics, establish savings systems, design of innovative solutions and quality of electricity, studies of the natural resources of the environment, to contribute to sustainable development and the rational and efficient use of energy in order to improve the competitiveness of the company where they work and contribute to the sustainable development of the region. With our equipment, teachers will be able to develop skills in Basic Studies, Energy Efficiency, Solar Thermal, Micro Grid, Power Plants, Smart Grid, to name a few. With this proposal, De Lorenzo seeks to improve, enrich, and develop cognitive and social processes in terms of professional competencies made up of knowledge, skills and attitudes for a comprehensive training of the student.



SOLUTION LABORATORY FOR RENEWABLE ENERGIES

Read more



BASIC INTRODUCTION

Expansion in the use of alternative energies requires a basic knowledge in order to acquire tools and skills that allow the study, planning, design, simulation of clean energy generation systems. The basic instruction kits for renewable energies form a preparatory course that introduces the student to the different sources of renewable energy and the physical phenomena that allow its conversio...

Read more

ENERGY EFFICIENCY

The efficient use of energy or energy saving is intended to reduce the amount of energy required to provide products and services. An appliance, process or installation is energy efficient when it consumes less than the average amount of energy to perform an activity. An efficient person, service or product committed to the environment, in addition to needing less energy to do the same work, also...

Read more

SOLAR PHOTOVOLTAIC

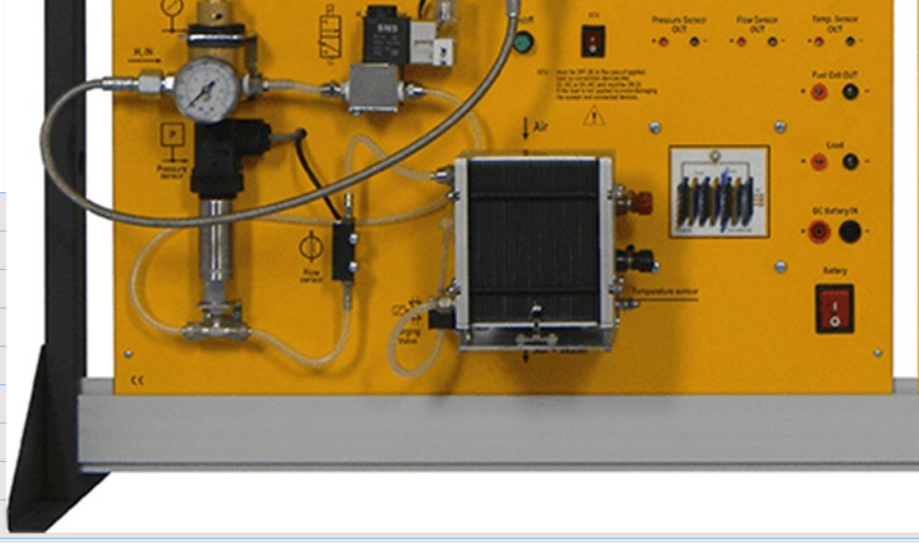
A solar photovoltaic system (PV system) is a power system designed to supply usable solar power by means of photovoltaics; it converts sunlight or solar radiation into direct current electricity by using semiconductors. To allow users of different preparation to study this system in its variants, De Lorenzo has developed a large number of trainers that deal with it for basic, medium and high leve...

Read more

WIND

Wind energy captures the natural wind and converts the air’s motion into mechanical energy usually for electricity production and this mechanism is referred to a wind-electric turbine. The turbine blades are normally designed to capture the kinetic energy in wind and when start moving, they spin a shaft that leads from the hub of the rotor to a generator that turns the rotational energy into elec…

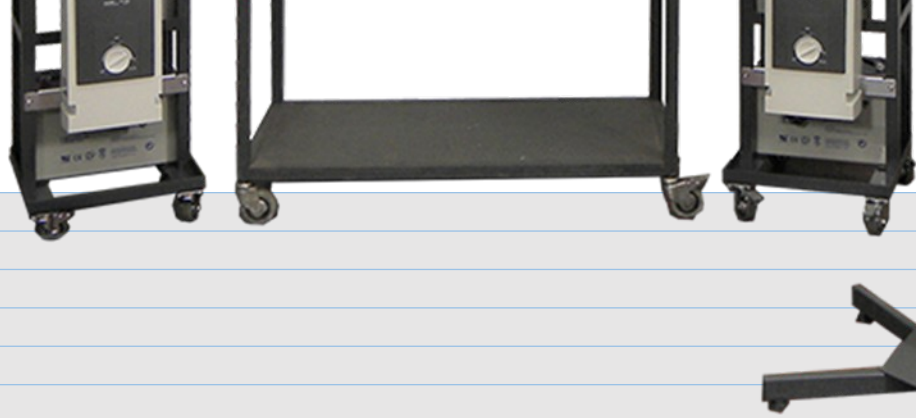
Read more



FUEL CELL

Fuel cells are devices that produce electricity by a chemical reaction taking place at the electrodes (anode and cathode). Hydrogen is the basic fuel but the fuel cells also require oxygen. They generate electricity with very little pollution; much of the hydrogen and oxygen used in the generating electricity combine to form a harmless byproduct (water). A fuel cell provides a DC voltage that can...

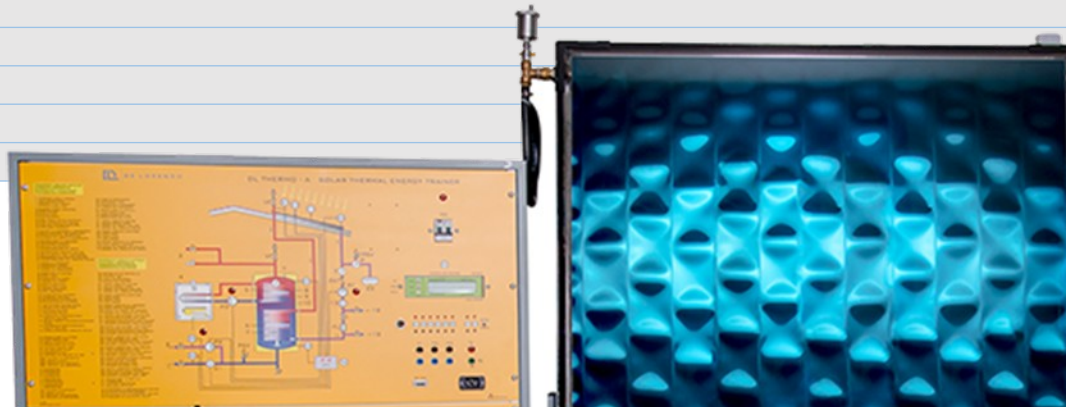
Read more



HYBRID SYSTEMS

Hybrid renewable energy systems are becoming popular as stand-alone power systems (off-grid, not connected to any electricity distribution system) for providing electricity in remote areas due to advances in renewable energy technologies. A hybrid energy system usually consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance...

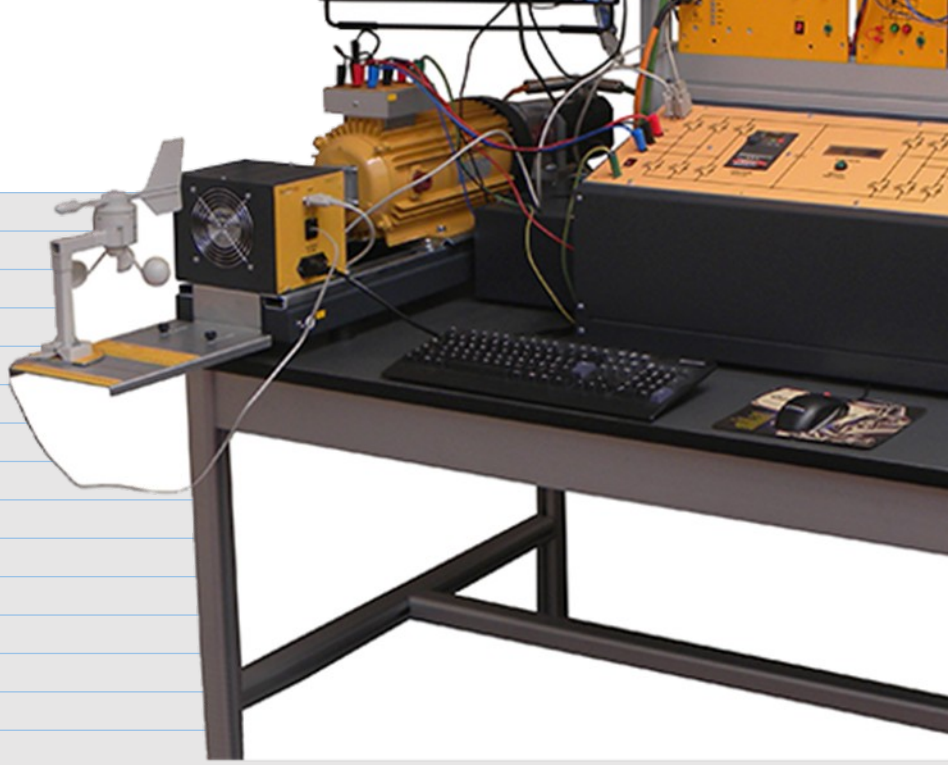
Read more



SOLAR THERMAL

Solar thermal energy is the use of energy from the Sun to transfer it to a heat carrier medium, usually water or air. It is a renewable, sustainable, and environmentally friendly energy. This form of energy generation can be applied in homes and domestic facilities, but also in large solar thermal power plants. Among the different applications of this renewable energy source, there is the poss...

Read more



POWER PLANTS

The generation of electrical energy consists of transforming a type of energy (chemical, kinetic, thermal, light, nuclear, solar, among others), into electrical energy. For industrial generation, facilities called power plants are used, which carry out some of the aforementioned transformations. These constitute the first step of the power supply system. As energy consumption will continue to...

SMART GRID

The term Smart Grid is used to refer to the smart electrical distribution network. They are basically electricity distribution networks combined with modern information technologies, which provide data to both electricity distribution companies and consumers. To provide intelligence to traditional electrical networks, telematic reading counters are added, that allow to know real-time consumpti...

Read more

Would you like to know more about our products?

We are at your complete disposal to answer your questions, tell us about your project, we will certainly be able to help you.

Contact us

Whatever has been achieved today can be improved on tomorrow.

This is why we are constantly looking at developing new products

and finding better solutions.

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Didactic Laboratories for **Renewable energies**

Didactic solutions for the future of

Sustainable Energy

16 Products

189 Practical experiences

170 h Theoretical lessons

85 h Practical lessons

KEY NUMBERS

→

30 STUDENTS

• Electronics Engineering

• Renewable Energy Engineering

• Energy Engineering

•

Energy Engineering and

Sustainable Development

• Engineering in Environmental

Technology

• Engineering in Natural

Resources Management

• Power Systems Engineering

• Technician in Renewable

Energies Solar Energy Area

• Technician in Alternative

Energy Sources

• Electrical Technician

WHO IS FOR

*It combines the topics covered in the Wind system and Photovoltaic system.

SMART ELECTRICAL SYSTEM

SOLAR THERMAL SYSTEM

PHOTOVOLTAIC SYSTEM

FUEL CELL

HYBRID SYSTEM*

WIND SYSTEM

LABORATORY [DL RENLAB]

RENEWABLE ENERGIES

Renewable energies are derived from infinite natural sources such as the sun, wind, water, and

biomass, which are continually replenished, making them less harmful alternative to fossil fuels. **De**

Lorenzo provides a wide range of educational systems designed for technicians, engineers, and

renewable energy specialists, helping them develop the skills needed to design and implement

sustainable energy projects. By assessing natural resources, students are empowered to create

innovative solutions for efficient energy use and sustainability.

Our systems are categorized by energy source and application (electricity or heat). **Our equipment**

offers hands-on learning in key areas such as solar, wind, and fuel cell technologies, while also

developing expertise in energy efficiency, micro-grids, and smart

grid integration.*It combines the topics covered in the Wind system and Photovoltaic system.

LABORATORY [DL RENLAB]

RENEWABLE ENERGIES

DL WPP

DL SPH-33

DL SGWD2.0-W

DL SPP

SMART ELECTRICAL SYSTEM

DL VAWT

DL GMLL

WIND SYSTEM

SOLAR THERMAL SYSTEM
DL THERMO-A12
DL GEOTHERM
HYBRID SYSTEM*
DL SUNWIND-A2
DL SUNWIND-24V3
FUEL CELL
DL HYDROGEN-B
DL HYGEN
PHOTOVOLTAIC SYSTEM
DL SOLAR-AT
DL SOLAR-PV
DL WIND-A2
DL WIND-B
www.delorenzoglobal.comThe laboratory proposal can be adjusted to fit clients needs -

LABORATORY [DL RENLAB]

RENEWABLE ENERGIES

30 STUDENTS

STATION

CODES

EXERCIZE

DESCRIPTION

Q.TY

COMPUTER

REQUIRED

PROFESSOR
STATION
-
-
PROFESSOR DESK
1
-
-
PROFESSOR CHAIR
1
-
-
PROFESSOR COMPUTER

1
-
-
PRINTER
1
-
-
-
INTERACTIVE WHITEBOARD
1
x
WIND
SYSTEMS
DL WIND-A2
17
ADVANCED WIND ENERGY
TRAINER
1
x
DL WIND-B_M230
6
WIND POWER TRAINER WITH
WIND TUNNEL
1
x
DL VAWT
2
SAVONIUS TURBINE
1
DL GMLL
2
GIROMILL TURBINE
1
DL 1001-1-08
BASIC BENCH 2 X 1 X 0.8 MT
1
PHOTOVOLTAIC
SYSTEMS
DL SOLAR-AT
15
PHOTOVOLTAIC SOLAR ENERGY

ADVANCED TRAINER
1
x
DL SOLAR-PV
8
PHOTOVOLTAIC SOLAR PANEL
MEASUREMENT TRAINER
1
x
DL 1001-1-08
BASIC BENCH 2 X 1 X 0.8 MT
2
HYBRID
SYSTEMS
DL SUNWIND-A2
17
ADVANCED WIND ENERGY
TRAINER
1
x
DL SUNWIND-24V3
21
HYBRID SOLAR / WIND ENERGY
TRAINER
1
x
DL 1001-1-08
-
BASIC BENCH 2 X 1 X 0.8 MT
1
FUEL CELL
DL HYDROGEN-B
5
FUEL CELLS SYSTEMS TRAINER
1
DL HYGEN
-
HYDROGEN GENERATOR
1

DL 1001-1-08
-
BASIC BENCH 2 X 1 X 0.8 MT
1
SOLAR
THERMAL
SYSTEM
DL THERMO-A12_M230
22
SOLAR THERMAL ENERGY
TRAINER
2
DL GEOTHERM
15
GEOTHERMAL ENERGY TRAINER
1
x
SMART
ELECTRICAL
SYSTEM
DL SPH-33
5
PELTON TURBINE WITH DC
GENERATOR
1
x
DL WPP
8
WIND POWER PLANTS
1
DL SPP
11
SOLAR POWER PLANT
1
DL SGWD2.0-W
35
SMART GRID WITH WIND
MICROGENERATION

1

x

DL 1001-1-08

-

BASIC BENCH 2 X 1 X 0.8 MT

1

FURNITURE &

COMPUTERS

-

-

STUDENT CHAIR

30

-

-

-

STUDENT COMPUTER

7

-

CABINET

6 **Educational Innovation** for a Sustainable Future

- **PEOPLE**
- **INNOVATION**
- **AGE**
- **TEAMWORK**
- **QUALITY**
- **HONESTY**

AND INTEGRITY

- **FLEXIBILITY**
- **INVOLVEMENTS**

Our

mission is to provide

cutting-edge educational solutions

that equip new generations of

technicians and engineers in the renewable energy sector. In a world facing increasingly urgent environmental challenges, De Lorenzo is committed to creating innovative educational laboratories that allow students to gain both practical and theoretical skills in sustainable energy. By integrating **technology**, **pedagogy**, and **hands-on experience**, our goal is to support the development of cleaner, more efficient energy solutions, contributing to the training of professionals capable of leading the transition toward a sustainable future.

MISSION

www.delorenzoglobal.com

ALUES

V

Our **Shaping the Future, Fueling Innovation**

Tailored Solutions

for Effective Learning

LABORATORIES

De Lorenzo is a comprehensive provider of **educational services**. Its offerings include laboratories designed to facilitate the transfer of technical knowledge and essential soft skills, such as:

PROBLEM SOLVING

CRITICAL THINKING

TEAMWORK

For each discipline, De Lorenzo provides fully **equipped laboratories** with

high-quality tools and materials, essential for achieving educational goals.

Our setup provides a turnkey, **flexible, and fully customizable solution**

to meet any educational need. Whether for small classes or large groups, our labs

can be scaled with the right number of products to ensure an optimal and

engaging learning experience. **01**

2

3

Proposal

of the necessary

equipment to

furnish the

laboratory*.

Listening

to the client’s needs.

Definition of the

teaching objectives,

and analysing the

socioeconomic

context of the region.

Analysis

of the available

teaching spaces,

pre-existing

resources and

technical expertise.

4

Definition

of the relevant

laboratories to reach

the desired teaching

objectives.

STEPS

for a succesful project

www.delorenzoglobal.comTechnical

Expertise

> product

Design

> interface

OUR PRODUCTS

Technology that teaches,

innovation that inspires

Creating **turnkey educational labs** that boost student engagement and

simplify teaching is an integral part of De Lorenzo's DNA. We are committed to the

continuous improvement of our products to facilitate both learning and teaching,

and to implementing cutting-edge techniques for effective knowledge transfer.

De Lorenzo’s products embody a synthesis of **TECHNICAL, PEDAGOGICAL, and DESIGN** expertise. To effectively facilitate knowledge transfer, it is essential to consider all of these aspects. **In the design of educational labs, the elements of interaction between users and product (Design) and between users and subject matter (Pedagogy) are just as crucial as technical knowledge.**

Pedagogy

> User

TECHNICAL EXPERTISE

Engineering Precision, Boundless Learning

Our products are crafted by passionate technicians and engineers who work to

make every essential technology accessible for education in today’s society.

De Lorenzo products embody both the **substance of the subjects they teach** and

the tools to teach them. Technology that demonstrates and teaches itself.

The designers at De Lorenzo understand the challenges faced by students and educators, striving to remove barriers in learning and teaching. This commitment ensures that our products make complex subjects easier to access and understand.

DESIGN

Functionality that inspires, aesthetics that engage

The products that compose the De Lorenzo laboratories are educational. Therefore,

the interaction between the user and the product is central. For this reason, De

Lorenzo products are created in Italy, designed to facilitate the user experience and

enhanced by **didactic manuals and software that simplify teachers' work and**

encourage student learning.

Colours, international symbology, a clear interface and the ergonomics of the

components are just some of the features considered during the design process.

INSTINCTIVELY COMPREHENSIBLE

EASY TO USE

Synoptic tables, images and international coding make it easy to find your way around

Self-explaining

FUNCTIONAL Intuitive: designed to simplify learning

RESISTANT

Manufactured in Italy, with high quality raw materials

MODULAR

Replaceable, interchangeable, easily repairable

COHERENT

Appearance, mode of use, maintenance

WITH RELEVANT AESTHETICS Well-finished aesthetics facilitates attention maintenance

SAFE Product and line safety is guaranteed

CHARACTERISTICS PEDAGOGY

Maximising the potential of every learner

Experience-based learning

Integration of theory and practice

Immediate feedback

Didactic support

Continuous evaluation

Autonomous learning

Collaboration and teamwork

Integration and accessibility

Reflectiveness and critical thinking
De Lorenzo develops teaching equipment that integrates fundamental
pedagogical principles such as **simulation of real challenges, repetition,**
imitation and playfulness. The laboratories support teachers in creating
captivating lessons, keeping students' attention high.
The laboratories facilitate the application of these principles, but do not replace the
teachers' skills. For this reason, De Lorenzo **trains teachers through its Academy**,
enabling them to exploit the products’ potential to the fullest, even **creating new**
experiments in addition to those in the manuals. In fact, De Lorenzo's products are
open and allow the exercises to be extended.

FUNDAMENTAL PEDAGOGICAL PRINCIPLES

An environment dedicated to the choice, design and use of teaching laboratories, where theory meets practice, offering students a complete educational experience.

A team of professionals who solve the problems of consultants and teachers daily will provide you with a 360° view of the potential of the products to create high-level teaching, making you autonomous in their exploitation.

A team that has gained experience and skills over the years in national and international design, production, and consultancy will explain to you how to choose laboratories, optimise resources, and didactically use the product for the transfer of technical knowledge.

KEY NUMBERS

106 hours of training per year

16 courses per year

5 Trainers in HQ

12 Trainers on-site

70 countries of origin of trainees

Courses available in 5 languages

WHO IT IS ADDRESSED TO

Professors

Educational consultants

Resellers

HR development managers

Ministers

ACADEMY

From design to autonomy:

your educational partner

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Experience the

Future of Education.

Let’s Talk About

Your Project!

Products

DOUBLE ELEVATOR MODEL

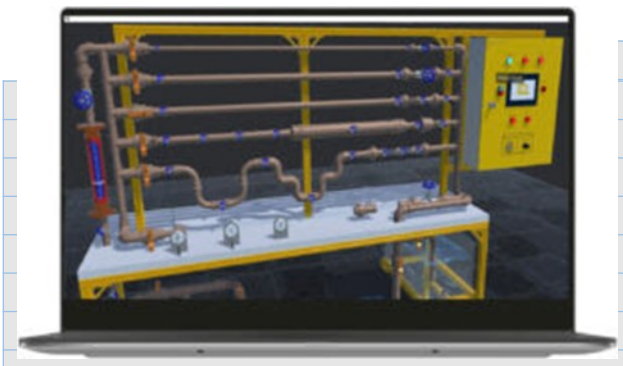
DL LIFT4.0

SINGLE ELEVATOR MODEL

DL LIFT2.0

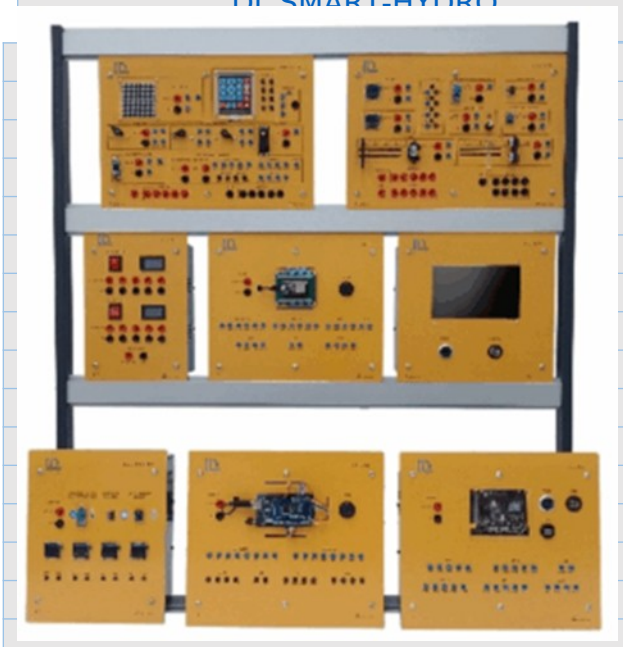
BATTERY

BAT100AGM



HYDRAULICS APPLICATIONS TRAINING

DL SMART-HYDRO



LABORATORY FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE FOR COLLEGES

DL AI-BASE

SATELLITE COMMUNICATION NETWORK TECHNOLOGY TRAINER

DL 2598SC

SMART LIGHTING TRAINER

DL SMART-DALI

UNIVERSAL BASE

1013A-AS

NAPĘD HYBRYDOWY – RÓWNOLEGŁY

DL AM20

SYMULATOR NAPĘDU AUTA ELEKTRYCZNEGO (EV)

DL AM23

ELEKTRYCZNY UKŁAD NAPĘDOWY AUTA (EV) STANOWISKO DYDAKTYCZNE -

DL DM47 -

LABORATORIUM MASZYN ELEKTRYCZNYCH STEROWANIE PÓŁAUTOMATYCZNE (SEMI AUTOMATIC) -

DL OPENLAB-SA -

TOYOYA PRIUS gen. IV HYBRYDOWY SAMOCHÓD SZKOLENOWY (PHEV) -

DL DM51 -

OGNIWO PALIWOWE – STANOWISKO DYDAKTYCZNE

DL HYDROGEN-B

POJAZD ELEKTRYCZNY (BEV) STANOWISKO DYDAKTYCZNE

DL DM53

POJAZD HYBRYDOWY – TOYOTA PRIUS IV, HYBRID PHEV STANOWISKO DYDAKTYCZNE -

SMART BUILDING

SMART BUILDING LABORATORY

DL SMART-DALI

“SMART LIGHTING TRAINER”

The picture is for reference only

INTRODUCTION

Smart building technology is revolutionizing the way we design, manage, and experience buildings.

By integrating advanced systems, smart buildings offer enhanced efficiency, sustainability, and

safety. The cutting-edge technologies enable seamless control of lighting, HVAC systems, fire safety,

and security, while promoting energy optimization and user comfort.

The “smart building” concept refers to a structure that uses advanced technologies such as sensors,

actuators, and automation systems to monitor and control building operations and the goal is to

improve energy efficiency, comfort, safety, and overall building performance.

This specific lighting system is a cutting-edge training center dedicated to advancing lighting

technology studies. It uses **DALI** (**D**igital **A**ddressable **L**ighting **I**nterface) technology as the protocol

for digital lighting control. It is specialized in **DALI** fundamentals, installation and troubleshooting,

control and automation, system monitoring and integration, and **AI**-driven lighting solutions. Its

mission is to cultivate skilled engineers and technicians for the smart building industry's lighting

sector.

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We reserve the right to modify our products without prior notice.

SMART BUILDING

DALI is a standardized lighting control system that enables flexible, precise management and

communication between lighting devices in smart building environments.

It allows for flexible, digital control of lighting systems, making it ideal for modern smart buildings

such as:

· Office buildings with dynamic lighting needs,

· Smart homes with automated lighting scenes,

· Hospitals and schools for energy-efficient lighting control,

· Street lighting systems.

Regarding “**how it works**”, a DALI controller sends digital signals over the DALI bus, each DALI device

listens for commands addressed to it, and the devices can respond with status information or

execute commands like dimming, switching, or scene recall.

Here's a diagram illustrating a **basic DALI lighting setup.**

TRAINING OBJECTIVES

This trainer **DL SMART-DALI** is designed to equip users with comprehensive knowledge and hands-on skills

in **DALI** lighting field. It is aimed at a wide audience, including non-experts, highly intuitive and simple to use

through a user-friendly interface.

It is flexible enough to meet every need, from the simplest to the most complex, helping the user by

simplifying and speeding up many of the most common everyday tasks.

It requires no special care and even in case of failure, it is able to provide the service for which it was designed,

or a similar one in the case of reduced operation.

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We reserve the right to modify our products without prior notice. **SMART BUILDING**

It can be fully configured quickly and intuitively using a software and the system can be accessible from any

device connected to the same LAN.

By the end of the training, the users will be able to:

· Understand the Fundamentals of DALI Lighting.

· Master DALI System Installation and Troubleshooting.

· Develop Skills in DALI Control and Automation.

· Gain Proficiency in DALI System Monitoring and Integration.

· Apply AI in Lighting Control.

LABORATORY'S COMPOSITION

This trainer is composed of a main panel on which all DALI devices (sensors and control gear) are placed.

Through this panel, the user will perform the DALI configuration, interfacing input devices with DALI devices,

integrating luminaires into DALI control gear, and accessing the DALI system using the software.

On this front panel and where the manual settings are made during the installation phase, the users gain

hands-on experience with real industrial equipment thanks to direct interaction with DALI devices.

In addition to the operation panel, the system offers a visualization space to better observe the automation

performance. There is a showroom where the main parts of DALI sensors and luminaires are installed to

simulate various environments, such as parking lots, outdoor areas, offices, meeting rooms, corridors among

others.

Unlike conventional installations where all devices are placed on the same 2D panel, sensors and luminaires

in the showroom are positioned in a more realistic setting. This enhances the natural occurrence of

automation and makes its visualization more intuitive.

The input devices include DALI control panels such as an 8-key push-button panel and a DT8 touch panel to

enhance the manual control experience. The sensors consist of motion sensors and illuminance sensors. The

luminaires include single-color LEDs, CCT LEDs, and RGBW LEDs.

SCADA IN DALI LIGHTING

SCADA (**S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition) is an industrial control system that monitors, gathers, and

processes real-time data to manage and control equipment and processes across various industries.

In smart buildings, the **BMS** (**B**uilding **M**anagement **S**ystem) manages and supervises all functional modules.

When we focus on one functional module, such as the DALI Lighting system, we move to a lower level of

management and supervision, dealing with critical statuses and decision-making controls of the DALI system.

In the process of using **SCADA**, smart building operations management specialists will gain an understanding

of the key elements they need to monitor within the smart building and its various functional departments,

enabling them to respond promptly in emergency situations.

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We reserve the right to modify our products without prior notice. **SMART BUILDING**

The lab covers the following topics:

· DALI Fundamentals:

o Introduction, Components, and Wiring.

o Communication and Configuration.

· Installation and Troubleshooting:

o System Installation & Pre-Commissioning Checks.

o Device Addressing and Basic Commissioning.

o Common DALI Faults.

· Control and Automation:

o Manual Device & Group Control, Scene Configuration.

o Color Temperature & Dynamic Color Control.

o Automated Control, Scheduling & Event-Triggered Automation.

o Smart Lighting & Circadian Lighting Design.

· DALI System Monitoring and Integration:

o DALI Monitoring in SCADA & Smart Buildings.

· AI-driven Lighting Solutions:

o AI-Based Analysis of User lighting Patterns for Predictive Control.

REAL APPLICATIONS INCLUDED IN

THEORETICAL & EXPERIMENTAL TOPICS

TELECOMMUNICATIONS

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SATELLITE COMMUNICATION NETWORK TECHNOLOGY TRAINER

DL 2598SC

INTRODUCTION

This trainer is mainly designed for "Satellite Communications", "Mobile Communications
Engineering", "Microwave Technology and Antennas", "Microwave Electronics" and other topics in
microwave and satellite communications, electronic information engineering, military
communication network and command in major technical secondary schools, including the latest
products developed for graduation projects.
The satellite communication is a method that uses electromagnetic waves in space as a carrier to
transmit information. It is not subject to geophysical interference. Therefore, satellite
communication is one of the other wireless communication methods in aerospace communications,
navigation, and personal remote area communications, especially in military communications.
This equipment adopts a fully open microstrip circuit design concept, allowing students to more
intuitively understand and master the design methods of microstrip active and passive circuits, and
can directly train students’ hands-on, thinking, and innovation abilities. It lays a practical foundation
for future practical work, and it can also be used for scientific research experiments, e.g. to do

simulated self-loop communication experiments.

TELECOMMUNICATIONS

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MAINS FEATURES

According to the different orbits of communication satellites above the earth, they can be divided

into synchronous and non-synchronous satellite communication systems. This equipment is a

geosynchronous satellite communication system.

In addition, there are several frequency band allocations for satellite communications. Among them

are L-band, C-band, Ku-band, and Ka-band. This equipment uses the C-band, which is the earliest

and most widely used.

It has the following features in C-band:

- 5.925 ÷ 6.425GHz for transmission, €
- 3.7 ÷ 4.2GHz for reception, €
- 500MHz for sending bandwidth, €
- 500MHz for receiving bandwidth. €

It adopts a modular structure, and all microwave circuits are open and visible to facilitate students'

intuitive learning.

It is designed and manufactured according to the secondary frequency conversion scheme common

to industrial products, to facilitate the students to integrate with reality.

It can be flexibly combined to be configured for simplex or duplex communication and, depending

on the terminal equipment, Frequency Division Multiple Access (FDMA), Time Division Multiple

Access (TDMA), Code Division Multiple Access (CDMA), or Hybrid Multiple Access (HMA) can be

used. The experimental box in this equipment takes FDMA as an example.

PERFORMANCE PARAMETERS

Main performance indicators of sending equipment

- Transmission frequency: 5.925 ÷ 6.425GHz, €
- Emission level: 0dBm ÷ 10dBm (1 ÷ 10mW), 1dB step, €
- System gain: ≥ 50dB, €
- First IF (low IF): 140MHz, €
- Second IF (High-mid frequency): 1.06GHz, €
- Bandwidth (per band): 20 ÷ 40Mhz, €
- Video and Audio modulation methods: QAM, €
- Modular output level: -5dBm ± 2dB. €

Main performance indicators of receiving equipment

- Working frequency: 3.7 ÷ 4.2GHz, €
- Receiver sensitivity: -80 ÷ -50dBm, €
- System gain: ≥ 60dB, €
- First IF (low IF): 140MHz, €

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• Second IF (High-mid frequency): 1.165GHz,	€
• Gain control range (MGC, AGC): ≥ 31.5dB,	€
• Video and Audio demodulation methods: QAM.	€
Local oscillator frequency combiner	
• L band frequency range,	€
◆ Receive: 1235 ÷ 1305MHz,	€
◆ Send: 920 ÷ 990MHz,	€
◆ Step: 1MHz.	€
• C-band frequency range,	€
◆ 4.8 ÷ 5.5GHz,	€
◆ Step: 20MHz.	€
• Frequency stability: ± 5ppm or (1 ÷ 2) x 10^{-5} ,	€
• Local oscillator combiner phase noise: -80dBc/Hz@10k, -90dBc/Hz@100k (typical value),	€
• Spurious output: 50dBc (typical value).	€
Analog satellite transponder	
• Uplink receiving frequency range: 5.925 ÷ 6.425GHz,	€
• Downlink transmission frequency range: 3.7 ÷ 4.2GHz,	€
• Communication satellite transponder local oscillator frequency: 2 ÷ 2.25GHz,	€
• System gain: 40 ÷ 70dB,	€
• Receive sensitivity: -70 ÷ -30dBm,	€
• Frequency stability: ± 5ppm or (1 ÷ 2) x 10^{-5} ,	€
• Phase noise: -80dBc/Hz@10k, -90dBc/Hz@100k (typical value).	€

EXPERIMENTAL FUNCTIONS

- Can transmit colour image signals and voice signals at the same time, €
- Frequency shift repeater for mobile communications, €
- Microwave components and microwave circuit system testing, €
- Microwave Antenna Test Experiment, €
- Can provide practical microwave circuit design models (including amplifiers, various filters, €

mixers, and power dividers among others).

EXPERIMENTAL CONTENT

Overview of satellite communications

- Main features of satellite communications, €
- Composition of satellite communication network, €
- FDMA in satellite communication. €

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System principles, features, and functional technical indicators

- Main technical indicators and functions of the transceiver system, €
- Experimental system principal composition, €
- Experimental system characteristics. €

Satellite communication and networking experiment

- Peer-to-peer communication, €

◆ Network duplex communication (optional),	€
◆ Connection between satellite communication network, microwave communication	€
and mobile communication network (optional),	
◆ Satellite broadcasting network (optional).	€
Extended experiments in the experimental box	
◆ Experiments for additional circuits in the experimental box,	€
◆ Microwave antenna test experiment.	€
Microwave and satellite communication system components and unit circuit testing experiments	
◆ IF Image Modulator Experiment,	€
◆ IF Image Demodulator Experiment,	€
◆ Experiments on IF amplifier, bandpass filter, and gain control functions,	€
◆ Bandpass, bandstop filters and amplifier experiments for high and medium	€
frequency division systems,	
◆ Frequency synthesizer experiment,	€
◆ Experiments on C-band up and down-conversion systems,	€
◆ Test experiment of C-band receiving system,	€
◆ Test experiment of C-band transmitting system,	€
◆ Test experiment of C-band communication satellite transponder.	€

CONFIGURATION LIST

• Satellite communication network technology training platform (uplink)/1 set,	€
• Satellite communication network technology training platform (downstream)/1 set,	€
• Satellite transponder/1 set,	€
• 4G antenna/1 pair,	€
• 6G antenna/1 pair,	€
• Power cables and auxiliary cables.	€
• Detailed theoretical and practical manual.	€

Power supply: single-phase from the mains.

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SUGGESTED NECESSARY INSTRUMENT (NOT INCLUDED)

A **spectrum analyzer** with functions such as real-time spectrum, scanned spectrum, vector network

analysis, antenna feeder measurement, field strength measurement, interference positioning,

power measurement, signal modulation analysis, etc.

• For real time spectrum analysis:	€
◆ Frequency range: 5kHz ÷ 8GHz,	€
◆ Real time analysis bandwidth: ≥ 40MHz,	€

◆ Maximum sampling rate: 51.2MHz,	€
◆ Display mode: density spectrum, waterfall plot, power vs. time,	€
◆ Trigger modes: External Trigger, Intermediate Frequency Power, PPS Second Pulse,	€
Gate Control Scan, Frequency Template.	
• For scanning frequency spectrum analysis:	€
◆ Resolution bandwidth: 1Hz ÷ 5MHz,	€
◆ Noise level: -165dBm,	€
◆ Scanning time: 20µs ÷ 3000s (non-zero scanning width), 5ms ÷ 3000s (zero scanning	€
width),	
◆ Comprehensive amplitude accuracy: ± 1.5dB.	€
• For vector network analysis:	€
◆ Frequency range: 100kHz ÷ 8GHz,	€
◆ Measurement parameters: S11, S21,	€
◆ RF output power: 0dBm, 30dB adjustable,	€
◆ Display modes: echo/Standing Wave Ratio (SWR), insertion loss, Smith chart, phase,	€
group delay,	
◆ Effective directionality: ≥ 38dB (1MHz ÷ 8GHz),	€
◆ Dynamic range: 80dB (S21, 10kHz RBW, Log mag, Average = 50, >10MHz).	€
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TOYOYA PRIUS gen. IV

HYBRYDOWY SAMOCHÓD SZKOLENOWY (PHEV)

DL DM51

Prezentowane stanowisko dydaktyczne zostało zbudowane na bazie w pełni sprawnego auta

hybrydowego Toyota Prius PHEV, przeznaczonego dla kształcenia w szkolnictwie zawodowym

branży MOT i pokrewnych. Celem jest zapoznanie ucznia / studenta / kursanta z budową,

funkcjonalnością i diagnostyką pojazdów hybrydowych.

Pojazd reprezentuje aktualny stan techniki w obszarze napędów hybrydowych. Symulacja awarii

występujących w wybranych układach sterowania auta umożliwia poszukiwanie usterek wg.

symptomów awarii, co pozwala na zachowanie rzeczywitego charakteru diagnostyki warsztatowej,

przy zachowaniu standardów producenta auta.

Auto pozwala na zapoznanie z architekturą i miejscem mocowania poszczególnych komponentów

układów sterowania auta, ich funkcji i funkcjonalności. Stanowi przydatną pomoc dydaktyczną w

obszarze diagnostyki, analizy parametrów roboczych auta i systematyki sterowania układami, w tym

elementów sensoryki i wykonawczych (aktoryki).

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Stanowisko zostało zaprojektowane w sposób umożliwiający uczestnikowi szkolenia zdobycie

wiedzy i praktycznych umiejętności obsługi, diagnostyki i naprawy układów auta hybrydowego w

najbardziej efektywnej formie kształcenia.

PARAMETERY stanowiska

- Długość: 4480 mm, €
- Szerokość: 1745 mm, €
- Wysokość: 1490 mm, €
- Waga: 1420 kg, €
- Zasilanie : 12 V battery, €
- Bateria wysokonapięciowa: 21,5 Ah/207 V, €
- Paliwo: min. Pb95 (max. zawartość etanolu w paliwie - 10%); €

CECHY stanowiska

- W pełni funkcjonalne auto Toyota Prius PHEV, gen.IV, €
- Silnik Otto 1.8 L, maszyny elektr. MG1, MG2, przekładnia CVT, €
- Pola pomiarowe podłączone do €

dwóch

wybranych układów auta,

np. **ECM** – **E**lectronic **C**ontrol **M**odule & **PMC** – **P**ower **M**anagement **C**ontrol),

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Pola pomiarowe zostały zamocowane na długim przewodzie umożliwiającym mobilność

interfejsu, komfort pomiarów i dalszej analizy sygnałów. Pola pomiarowe pozwalają na

pomiar sygnałów elektrycznych na wybranych sterownikach układów auta przy

wykorzystaniu multimeteru/oscyloskopu (nie są na wyposażeniu stanowiska !).

Poniżej skrin ekranu pokazujący fragment schematu elektrycznego z instrukcji ćwiczeń

dostarczanej ze stanowiskiem.

PMC’s Wiring diagram

- Symulacja usterek dla 2 układów elektrycznych; €

zainstalowany w schowku auta, wyposażony w przełączniki symulacji usterek:

◆ 10 symulacji usterek w obwodach zarządzanych przez sterownik silnika (ECM), €

◆ 10 symulacji usterek w obwodach sterownika ukł. wysokonapięciowych (PMC),

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Przykładowe położenie zabezpieczonych przed dostępem kursanta włączników usterek, na schemacie elektrycznym.

OPIS SYMUOWANYCH USTEREK

- W obwodach sterownika **ECM**:

✓ Usterka nr 1: moduł cewki zapłonowej,

✓ Usterka nr 2: regulacja faz rozrządu zaworem elektromagnetycznym,

✓ Usterka nr 3: czujnik temperatury cieczy chłodzącej,

✓ Usterka nr 4: przepływomierz masowy powietrza (MAF),

✓ Usterka nr 5: czujnik położenia wału korbowego_1,

✓ Usterka nr 6: czujnik położenia wału korbowego _2,

✓ Usterka nr 7: zespół przepustnicy,

✓ Usterka nr 8: air / fuel sensor,

✓ Usterka nr 9: zawór węgla aktywnego,

✓ Usterka nr 10: Lambda sensor.

- W obwodach sterownika **PMC**:

✓ Usterka 1: inwerter silnika pompy wody,

✓Usterka 2: maszyna elektryczna MG2,	
✓Usterka 3: zespół chłodzenia baterii HV,	
✓Usterka 4: przekaźnik zapłonu IG2,	
✓Usterka 5: przekaźnik IGCT (Inspect Integration Relay),	
✓Usterka 6: potencjometr przyspieszenia,	
✓Usterka 7: czujnik położenia dźwigni biegów_1,	
✓Usterka 8: czunik położenia dźwigni biegów_2,	
✓Usterka 9: czujnik temperatury akumulatora HV,	
✓	
Usterka 10: przesył danych (utrata komunikacji pomiędzy sterownikami ECM a PMC).	

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DANE silnika

• Specyfikacja auta :	€
◆ Liczba cylindrów: 4/DOHC,	€
◆ Pojemność: 1798 cm3, silnik Otto pracujący w cyklu Atkinsona,	€
◆ Minimalna liczba oktanowa: RON 95,	€
◆ Układ zapłonowy: Toyota,	€
◆ Sensor zapłonu: wał korbowy/wałek rozrządu,	€

◆ Złącze diagnostyczne;	€
• Kolejność zapłonu:	€
◆ 1-3-4-2.	€
• Świece zapłonowe:	€
◆ Oryginalne marki Denso,	€
■ typ: SC20HR11,	
■ odległość elektrod: 1,0 – 1,1 mm	
◆ Oryginalne marki NGK,	€
■ typ: ILKAR7B-11,	
■ odległość elektrod: mm 1,0 – 1,1.	
• Układ zasilania:	€
◆ Ciśnienie robocze: 3,0 – 3,4 bar,	€
◆ Czujnik temp. silnika (ECT): Ω/°C 2320 – 2590/20,	€
◆ Czujnik położenia wału korbowego: Ω 1850 – 2450,	€
◆ Wtryskiwacz: Ω 11,6 – 12,4,	€
◆ Lambda sensor: Ω 11,0 – 16,0,	€
◆ Silnik sterujący zespołu przepustnicy : Ω 0,3 – 100.	€
AKCESORIA dodatkowe DL DM-MCS	
DL DM-MCS – **Mobile Charging Station** - ładowarka, parametry:	
Specyfikacja:	
• Czerwone gniazdo wtykowe CEE stosowane w ładowarkach domowych przewidzianych dla aut BEV,	€
długość przewodu 5 m.	
• Napięcie znamionowe WE/WY 85-380V AC,	€
• kodowanie standardowe 32A, alternatywnie: 10A/16A/24A,	€
• nominalna moc 22kW dla szybkiego ładowania,	€
• nominalne zabezpieczenie prądowe: TYP A+DC 6mA (30mA AC RCD + 6mA DC RCD),	€
• rezystancja przewodów >100 MΩ (DC500V),	€
• opór stykowy 0,5 MΩ max.	€
• Klasa oporności ogniowej: UL94V-0,	€

- przewód 5 x 6 mm2 + 1 x 0,5 mm2. €

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- Wskaźnik LED temperatury pracy, czasu ładowania i prądu ładowania. Zabezpieczenia przeciw € zawilgoceniu, nadmiarowo napięciowe i niskonapięciowe, zabezpieczenie przeciążeniowe, zabezpieczenie przed przegrzaniem.

Dodatkowy adapter Schuko kompatybilny z wtyczką CEE

Kompletny zestaw obejmuje instrukcję obsługi / ćwiczeń.

AUTOTRONICS - DEMONSTRATORS

RENEWABLE ENERGIES

SOLAR/WIND ENERGY TRAINER WITH BATTERY CHARGE REGULATOR AND BATTERY

DL SUNWIND-OG

Modular trainer for the theoretical and practical study of the electrical installations with photovoltaic solar energy and wind energy.
With the solar/ wind trainer it is possible

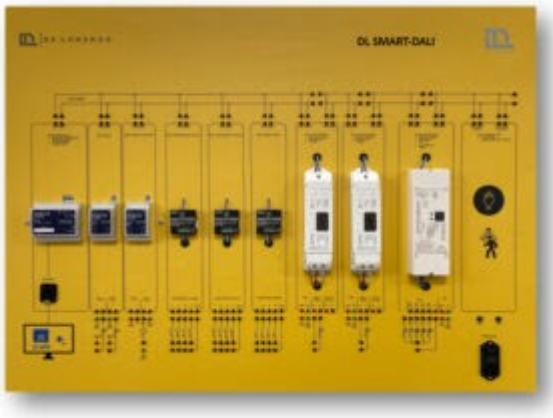
to perform experiments to determine	
the characteristics of a wind generator	
and a photovoltaic panel and study their	
off-grid operation with a battery charge	
regulator.	
Complete with connecting cables,	
experiment manual and **software for**	
data acquisition and processing.	
DIDACTIC EXPERIENCE	
STUDY OF PHOVOLTAIC SOLAR PANEL	
o Measuring solar radiation: Changing the	
inclination and azimuth of the solar panel	
o Investigating the PV module response to	
shadow formation	
o Recording the characteristics of the solar	
modules:	
-	
Solar Panel Voltage-Irradiation Curve	
-	
Solar Panel Current-Irradiation Curve	
(calculating the inner resistance of the	
solar panel)	
-	
Obtaining the solar panel current-voltage	
curve	
-	
Obtaining the solar panel current-power	
curve	
-	
Measurement of the voltage and current	
of the photovoltaic module with overload	
TECHNICAL SPECIFICATIONS	
• Electronic charge regulation module, with LCD	€
display, MPPT tracking and energy monitor	
• Battery protection module	€
• Rheostat module	€
• DC load module. It includes a 20W dichroic	€

lamp and 3W LED lamps, with independent	
switches.	
• Inclinable photovoltaic panel, approx. 90W,	€
12V, complete with a cell for measuring the	
solar irradiation and a temperature sensor.	
• Motor/generator group for the simulation of	€
a wind turbine. Composed of a brushless	
motor and a DC permanent magnet	
generator.	
• Control module for brushless motor drive	€
• Anemometer	€
• Off-grid inverter module	€
• AC load module. It includes a dichroic lamp	€
and LED lamps, with independent switches. **RENEWABLE ENERGIES**	
STUDY OF OFF-GRID SOLAR SYSTEM	
o Measuring the generated power of a PV	
system and battery charging	
o Using Solar Panel and Battery to supply a DC	
Load	
o Design and testing of a standalone PV system	
in direct storage operation and 230V AC	
STUDY OF WIND TURBINE	
-	
Identification of wind turbine components	
-	
Operating the Wind Turbine Breaker	
-	
Calculating wind power	
STUDY OF OFF-GRID WIND SYSTEM	
-	
Dimensioning of an off-grid wind system.	

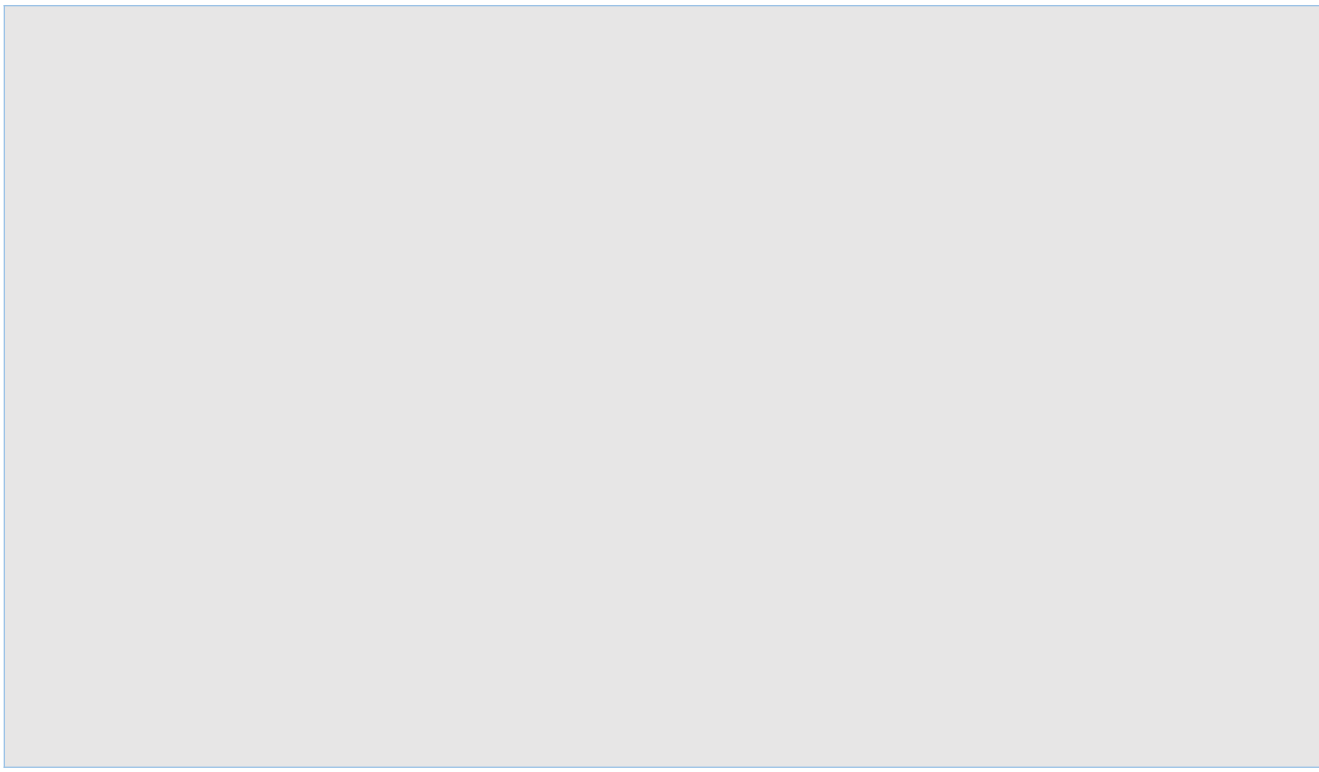
-
Battery regulating and charging
-
Supplying DC load with wind power stored in a battery
-
Supplying AC load with wind power and a battery.
-
Calculating the system autonomy with different loads
• Multifunction measurement module: solar irradiation, solar panel temperature, 2 DC power meters and 1 AC power meter. €
• Multifunction measurement module for wind applications: It includes four separate instruments to measure all fundamental parameters for the study of a wind-system. €
• 100Ah battery €
• 27Ah battery. €
• Three level frame €
• Wind turbine charge controller with brake system. €
OPTION:
DL SIMSUN - Sun simulator consisting of halogen

Skip to main content

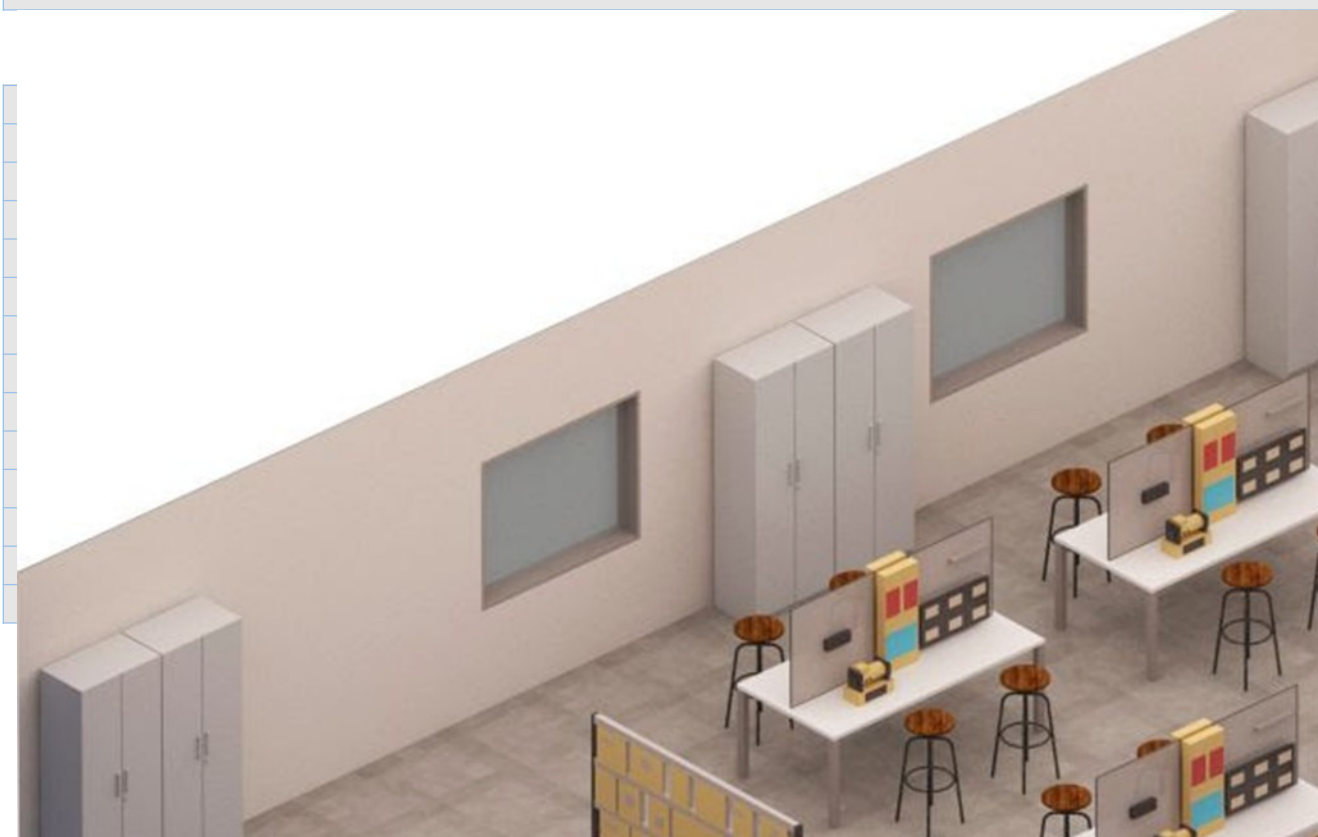
5

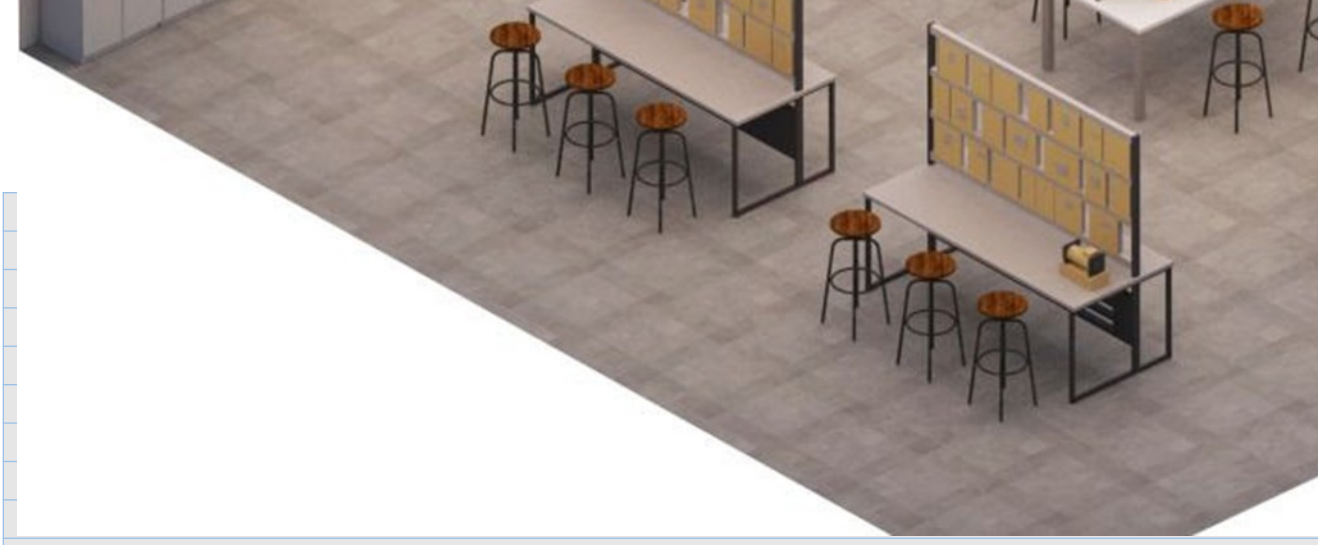


ELECTRICAL INSTALLATIONS



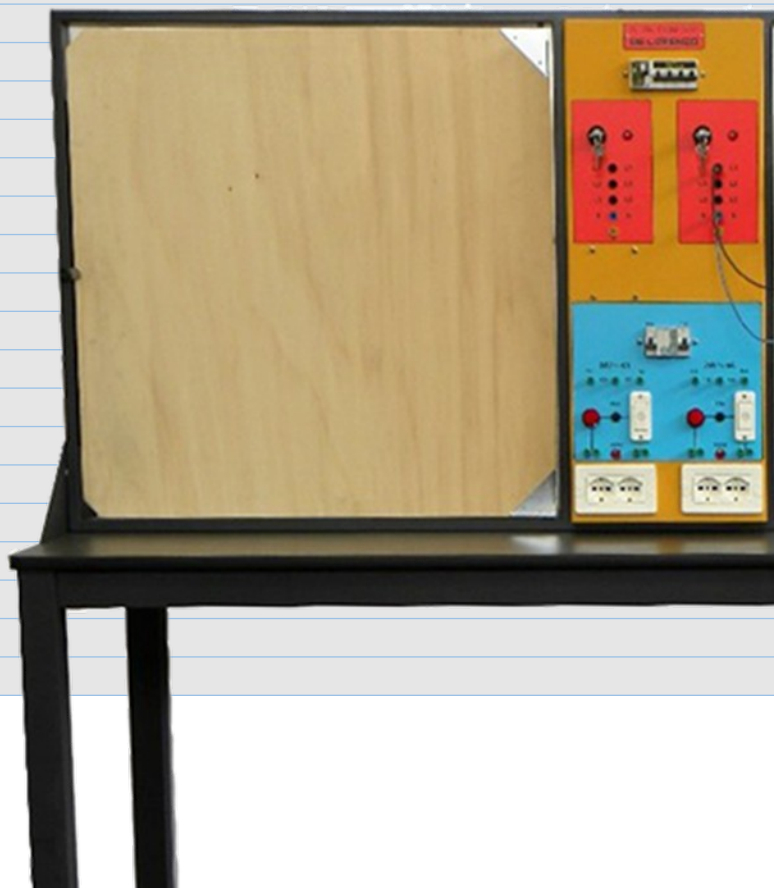
Electrical installations are the set of electrical circuits intended to provide electrical energy to buildings, installations, public places, and infrastructure in general. They include the necessary equipment to ensure their correct operation and the connection with the electrical devices for their operation. Currently, residential, commercial, and industrial electrical installations form the institutional nervous system. They are highly relevant since an inadequate design, faulty installation or poor maintenance can cause anything from the temporary stoppage of company operations to accidents and material damage in the home, business, or company. Most of the fires that occur in each of these environments are caused by failures in electrical installations. At De Lorenzo, we manufacture didactic systems so that technicians, engineers, and electrical specialists are able to develop theoretical-practical experience in the planning, development, and implementation of civil and industrial installations with the use of real industrial-grade components integrated in practical and flexible trainers. Electrical installation laboratories aim to develop cognitive processes and professional competencies comprised of knowledge, skills, and attitudes for comprehensive student training in the fields required by the industry, covering everything, from measurement and protection techniques to the concepts of industrial and home automation.





SOLUTION LABORATORY FOR ELECTRICAL INSTALLATIONS

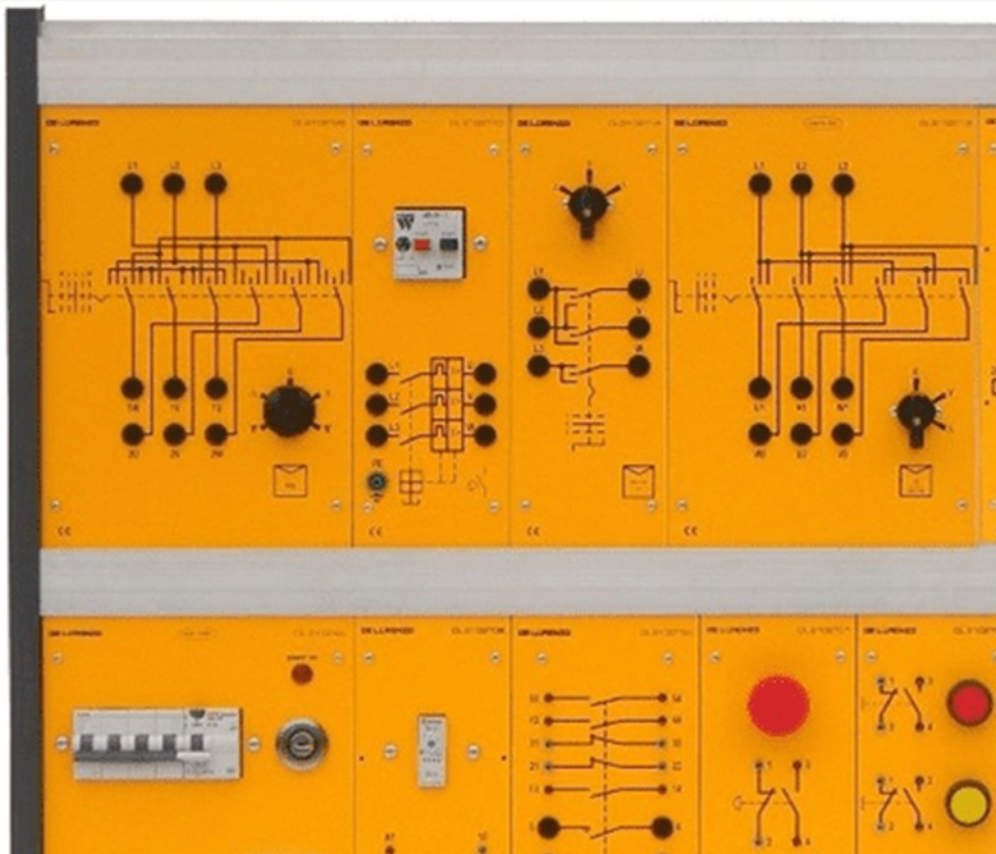
Read more

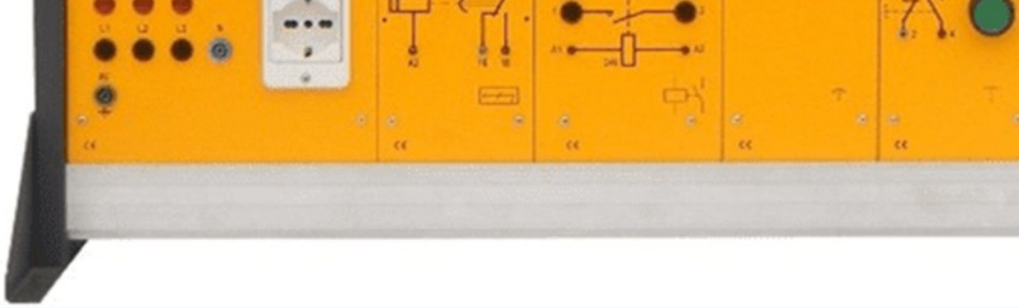


INSTALLATIONS KIT

The installation kits of our training systems allow to acquire all the knowledge and skills that the civil and industrial installers must have and provide the fundamental equipment for this purpose. They will learn everything they need to know to work in this field, from the basics of electricity to the installation and maintenance techniques of civil and industrial systems, and even those relati...

Read more





INDUSTRIAL INSTALLATIONS PANELS

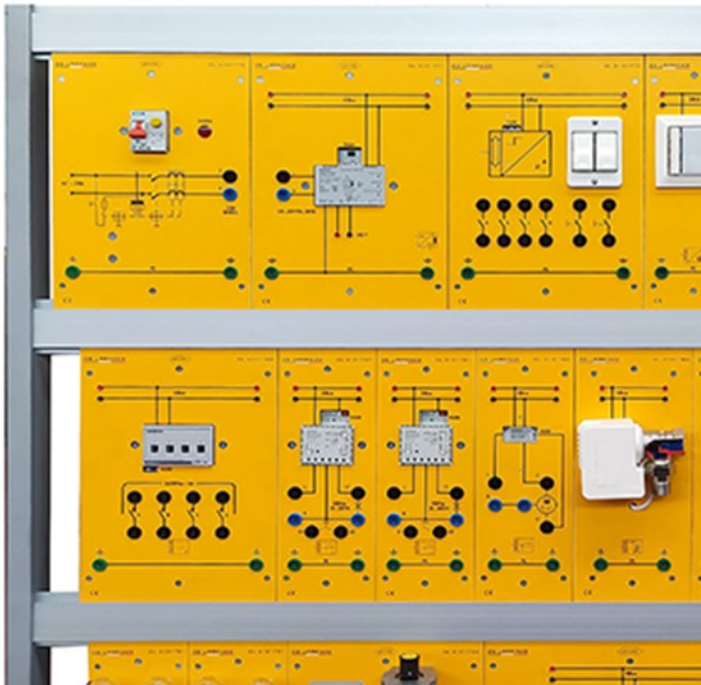
De Lorenzo presents the didactic solution of “industrial electrical installations panels”, used in factories and workplaces where industrial machinery is normally operated and automated. We have designed two versions, one with modular structure and one with kit structure, both using common industrial components. Following the modular methodology, a wide variety of study topics are covered r...

Read more

CIVIL INSTALLATIONS

Civil electrical installations are used in our homes and in public spaces such as schools and hospitals, to name a few examples. De Lorenzo has designed different modular trainers for the development of the skills of technicians, engineers, and specialists in the electrical area. Each laboratory consists of a set of modules, which combine industrial-grade components and didactic panels with sy...

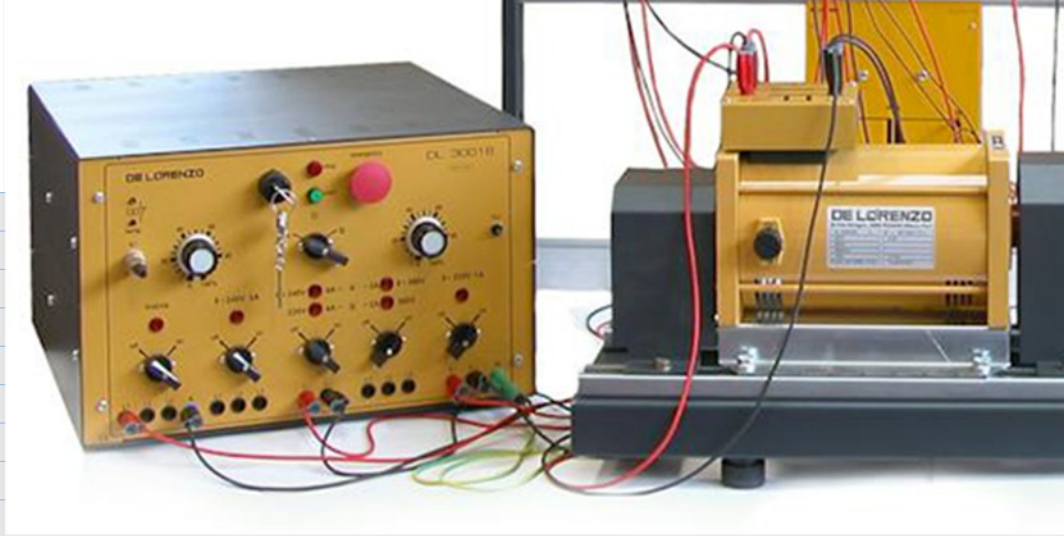
Read more



HOME AUTOMATION

This educational system is a complete laboratory for the study of the home automation technology. It has been developed to show the improvements that have been added during the recent years to reach higher safety, to live more comfortably, and to better perform the jobs and the activities among others such as in offices, schools, hotels, shops, factories. The modules integrate industrial componen...

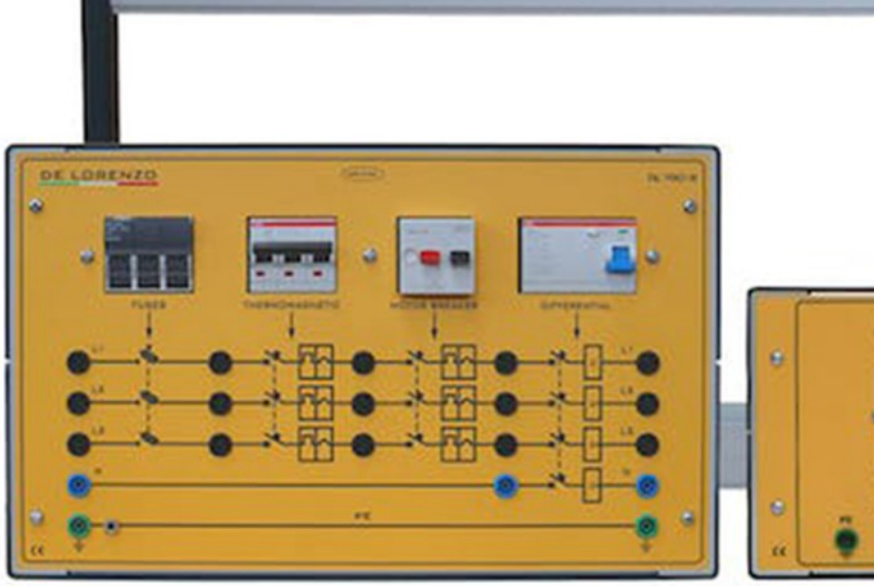
Read more



ELECTRICAL MEASUREMENTS

Students of electrical installations must be able to validate the operation of electrical installations and systems using measuring instruments for the electrical magnitudes. Electrical measurements are the methods, devices, and calculations used to measure the electrical quantities of a system. In this sense, De Lorenzo offers training systems in which the trainee can study all topics related...

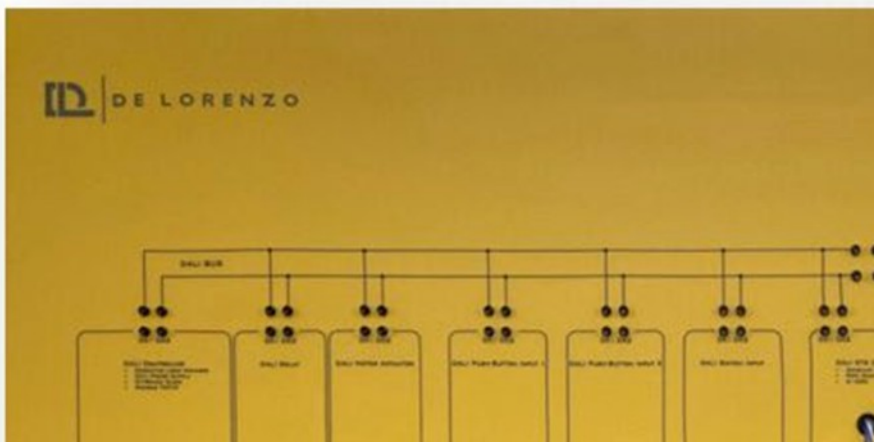
Read more



PROTECTIONS

In electrical systems, faults or malfunctions can occur. The main anomalous situations in which an electrical system can be found are short-circuit, electrical leakage, overload and overvoltage. To prevent these events from causing damage to persons or property, appropriate protective devices must be installed such as magnetothermic switch, circuit breaker, fuse, motor protection, etc. Furthermor...

Read more



SMART BUILDING LABORATORY

Smart building technology is revolutionizing the way we design, manage, and experience buildings. By integrating advanced systems, smart buildings offer enhanced efficiency, sustainability, and safety. The cutting-edge technologies enable seamless control of lighting, HVAC systems, fire safety, and security, while promoting energy optimization and user comfort. The “smart building” concept refer...

Read more

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Whatever has been achieved today can be improved on tomorrow.

This is why we are constantly looking at developing new products

and finding better solutions.

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lamps to provide energy to the photovoltaic
module for indoor use

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Didactic Laboratories for **Electrical Installations**

Didactic solutions for the future of Electrical Installations

30 STUDENTS

- Automation and Control Engineering
- Mechatronics Engineering
- Automation Technician
- Automatic Systems Maintenance Technician
- Mechatronics Technician
- Electric Technician

WHO IS FOR

8 Products

220 Practical experiences

220 h Theoretical lessons

110 h Practical lessons

KEY NUMBERS

→**LABORATORY [DL ELINSTLAB]**

ELECTRICAL INSTALLATIONS

Electrical installations are the set of electrical circuits intended to provide electrical energy to

buildings, installations, public places, and infrastructure in general. They include the necessary

equipment to ensure their correct operation and the connection with the electrical devices for their

operation.

Currently, residential, commercial, and industrial electrical installations form the institutional

nervous system. They are highly relevant since an inadequate design, faulty installation or poor

maintenance can cause anything from the temporary stoppage of company operations to accidents

and material damage in the home, business, or company. Most of the fires that occur in each of

these environments are caused by failures in electrical installations.

At De Lorenzo, we manufacture didactic systems so that technicians, engineers, and

electrical specialists are able to develop theoretical-practical experience in the planning,

development, and implementation of civil and industrial installations with the use of real

industrial-grade components integrated in practical and flexible trainers.

Electrical installation laboratories aim to develop cognitive processes and professional

competencies comprised of knowledge, skills, and attitudes **for comprehensive student training**

in the fields required by the industry, covering everything, from measurement and protection

techniques to the concepts of industrial and home automation.

ELECTRICAL

ELECTRICAL INSTALLATIONwww.delorenzoglobal.com

LABORATORY [DL ELINSTLAB]

ELECTRICAL INSTALLATIONS

DL 2102T

ELECTRICAL INSTALLATIONS

DL SMART-CIVIL

VIRTUAL LABORATORY ELECTRICAL INSTALLATIONS

PROTECTIONS

DL 1103

DL 2102C2 The laboratory proposal can be adjusted to fit clients needs

LABORATORY [DL ELINSTLAB]

ELECTRICAL INSTALLATIONS

30 STUDENTS

STATION

CODES EX.

DESCRIPTION Q.TY

COMPUTER

REQUIRED

PROFESSOR

STATION

-

-

PROFESSOR DESK

1

-
-
PROFESSOR CHAIR
1
-
-
PROFESSOR COMPUTER
1
-
-
PRINTER
1
-
-
INTERACTIVE WHITEBOARD
1
x
DL 2101T
23
TOTAL CIVIL INSTALLATIONS
1
DL 2102T
38 TOTAL INDUSTRIAL INSTALLATIONS 1
DL SMART-DASHBOARD-1A
CLASSROOM MANAGEMENT FOR
SMARTSIMS
1
x
ELECTRICAL
INSTALLATIONS
DL 1103
-
CENTRAL 4 PLACE WORK FRAME WITH
4 SUPPLIES
8
DL 1100SD
-
JUNCTION BOX
32
DL 1100D
-
GRID PANEL

	32
DL 1100E	
-	
STRIP PANEL	
	32
DL 1100C6	
-	
PANEL FOR FLUSH-MOUNTED CIVIL	
PLANTS WITH 6 TERMINAL BOXES	
	32
DL 1100A	
-	
TOOL KIT	
	32
DL 2101	
	21
CIVIL INSTALLATIONS	
	16
DL 2102C2	
	23
COMPLETE INDUSTRIAL	
INSTALLATIONS	
	16
DL 2102A	
-	
THREE-PHASE MOTOR	
	16
DL 2102D_F50	
-	
DAHLANDER MOTOR	
	16
DL 1100N	
-	
ENCLOSED BOARD HOUSING WITH 6	
PLACES	
	11
DL NTP001	
-	
NETWORK TECHNOLOGY TRAINING	
PACKAGE	
	8
DL SOLAR-KIT	
	7

SOLAR PHOTOVOLTAIC ENERGY
INSTALLATION KIT
8
VIRTUAL
LABORATORY
ELECTRICAL
INSTALLATION
DL S-CIVIL-30C50U
43
CIVIL ELECTRICAL INSTALLATIONS
VIRTUAL COURSE DL SMART-CIVIL
x
DL S-INDUST-30C50U
62
INDUSTRIAL ELECTRICAL INSTALLATIONS
VIRTUAL COURSE DL SMART-INDUSTRIAL
x
PROTECTIONS
DL PROT-EL
4
ELECTRICAL PROTECTION STUDY AND
COORDINATION
4
DL 1001-1-08
-
BASIC BENCH 2 X 1 X 0.8 MT 4
FURNITURES
-
STUDENT CHAIR
32
DL 1001-1-08
-
BASIC BENCH 2 X 1 X 0,8 MT 16
-
-
STUDENT COMPUTER
32
-
-
CABINET

10

1

1 **Educational Innovation** for a Sustainable Future

- **PEOPLE**
- **INNOVATION**
- **AGE**
- **TEAMWORK**
- **QUALITY**
- **HONESTY**

AND INTEGRITY

- **FLEXIBILITY**
- **INVOLVEMENTS**

Our

mission is to provide

cutting-edge educational solutions
that equip new generations of

technicians and engineers in the

renewable energy sector. In a world

facing increasingly urgent

environmental challenges, De Lorenzo
is committed to creating innovative
educational laboratories that allow

students to gain both practical and

theoretical skills in sustainable energy.
By integrating

technology,

pedagogy, and **hands-on**

experience, our goal is to support
the development of cleaner, more

efficient energy solutions,

contributing to the training of

professionals capable of leading the transition toward a sustainable

future.

MISSION

www.delorenzoglobal.com

ALUES V

Our **Shaping the Future, Fueling Innovation**

Tailored Solutions

for Effective Learning

LABORATORIES

De Lorenzo is a comprehensive provider of **educational services**. Its offerings

include laboratories designed to facilitate the transfer of technical knowledge and

essential soft skills, such as:

PROBLEM SOLVING

CRITICAL THINKING

TEAMWORK

For each discipline, De Lorenzo provides fully **equipped laboratories** with

high-quality tools and materials, essential for achieving educational goals.

Our setup provides a turnkey, **flexible, and fully customizable solution**

to meet any educational need. Whether for small classes or large groups, our labs

can be scaled with the right number of products to ensure an optimal and

engaging learning experience. **01**

2

3

Proposal

of the necessary

equipment to

furnish the
laboratory*.

Listening

to the client’s needs.
Definition of the
teaching objectives,
and analysing the
socioeconomic
context of the region.

Analysis

of the available
teaching spaces,
pre-existing
resources and

technical expertise.

4

Definition

of the relevant
laboratories to reach
the desired teaching

objectives.

STEPS

for a succesful project

www.delorenzoglobal.comTechnical

Expertise

> product

Design

> interface

OUR PRODUCTS

Technology that teaches,

innovation that inspires

Creating **turnkey educational labs** that boost student engagement and

simplify teaching is an integral part of De Lorenzo's DNA. We are committed to the

continuous improvement of our products to facilitate both learning and teaching,

and to implementing cutting-edge techniques for effective knowledge transfer.

De Lorenzo’s products embody a

synthesis of **TECHNICAL,**

PEDAGOGICAL, and DESIGN

expertise. To effectively facilitate

knowledge transfer, it is essential

to consider all of these aspects. **In**

the design of educational labs,

the elements of interaction

between users and product

(Design) and between users

and subject matter (Pedagogy)

are just as crucial as technical knowledge.

Pedagogy

> User **TECHNICAL**

EXPERTISE

Engineering Precision, Boundless Learning

Our products are crafted by passionate technicians and engineers who work to

make every essential technology accessible for education in today’s society.

De Lorenzo products embody both the **substance of the subjects they teach** and

the tools to teach them. Technology that demonstrates and teaches itself.

The designers at De Lorenzo

understand the challenges faced by

students and educators, striving to

remove barriers in learning and

teaching. This commitment ensures

that our products make complex

subjects easier to access and

understand. **DESIGN**

Functionality

that inspires,

aesthetics that engage

The products that compose the De Lorenzo laboratories are educational. Therefore,

the interaction between the user and the product is central. For this reason, De

Lorenzo products are created in Italy, designed to facilitate the user experience and

enhanced by **didactic manuals and software that simplify teachers' work and**

encourage student learning.

Colours, international symbology, a clear interface and the ergonomics of the

components are just some of the features considered during the design process.

INSTINCTIVELY COMPREHENSIBLE

EASY TO USE

Synoptic tables, images and international coding make it easy to find your way around

Self-explaining

FUNCTIONAL Intuitive: designed to simplify learning

RESISTANT

Manufactured in Italy, with high quality raw materials

MODULAR

Replaceable, interchangeable, easily repairable

COHERENT

Appearance, mode of use, maintenance

WITH RELEVANT AESTHETICS Well-finished aesthetics facilitates attention maintenance

SAFE Product and line safety is guaranteed

CHARACTERISTICS PEDAGOGY

Maximising the potential of every learner

Experience-based learning
Integration of theory and practice
Immediate feedback
Didactic support
Continuous evaluation
Autonomous learning
Collaboration and teamwork
Integration and accessibility
Reflectiveness and critical thinking
De Lorenzo develops teaching equipment that integrates fundamental
pedagogical principles such as **simulation of real challenges, repetition,**
imitation and playfulness. The laboratories support teachers in creating
captivating lessons, keeping students' attention high.
The laboratories facilitate the application of these principles, but do not replace the
teachers' skills. For this reason, De Lorenzo **trains teachers through its Academy**,
enabling them to exploit the products’ potential to the fullest, even **creating new**
experiments in addition to those in the manuals. In fact, De Lorenzo's products are

open and allow the exercises to be extended.

FUNDAMENTAL PEDAGOGICAL PRINCIPLES **An environment** dedicated to the choice, design and use of teaching laboratories, where theory meets practice, offering students a complete educational experience.

A team of professionals who solve the problems of consultants and teachers daily will provide you with a 360° view of the potential of the products to create high-level teaching, making you autonomous in their exploitation.

A team that has gained experience and skills over the years in national and international design, production, and consultancy will explain to you how to choose laboratories, optimise resources, and didactically use the product for the transfer of technical knowledge.

KEY NUMBERS
106 hours of training per year
16 courses per year
5 Trainers in HQ
12 Trainers on-site
70 countries of origin of trainees
Courses available in 5 languages
WHO IT IS ADDRESSED TO
Professors
Educational consultants
Resellers
HR development managers
Ministers
ACADEMY
From design to autonomy:
your educational partner
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Future of Education.
Let’s Talk About
Your Project!

WORK BENCHES FOR ELECTRIC INSTALLATIONS

FOUR PLACE WORK BENCH WITH 4 INDEPENDENT SUPPLIES

DL 1103

The picture shows the work bench (DL 1103) together

with the wooden panel (DL 1100B), the grid panel (DL

1100D) and the panel with 6 junction boxes (DL 1100C6),

plus some components.

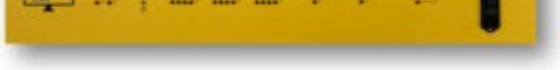
For each side the following power supplies

are provided:

- 2 three-phase + N + T, 16A outputs on 36A safety terminals according to IEC 61010-1; protection through differential, magneto thermal, 4-pole, 16A automatic switch, pilot lamp and key switch for teacher control. €
- 4 outputs on 10/16 A single-phase mains sockets, protection through differential, magneto-thermal, 16A automatic switch and pilot lamp. €
- 2 outputs isolated from the mains, 0-12-24Vac, 4 A on isolated terminals, protection through magneto-thermal, automatic switch. €
- 2 optical and acoustic circuit testers on isolated terminals, protection through fuses. €

Dimensions: 200x80x175 cm.

Skip to main content



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ELECTRICAL INSTALLATIONS

INSTALLATIONS KIT

CIVIL INSTALLATIONS KIT

CIVIL INSTALLATIONS KIT

An electrical plant indicates, in the field of electrical engineering, the set of electrical, mechanical and physical equipment suitable for transmission and use of electrical energy. The professional figure that deals with the creation and maintenance of these systems is that of the electrician and the civil electrical installations plants are one of the largest categories. They are used in private homes and public access places such as schools and hospitals. De Lorenzo, for this category, has designed different trainers in two versions; one having modular structure of didactic panels, with symbols and diagrams, arranged on a vertical frame and another having workbench structure with panels and kits targeted to installers. The topics covered in the civil electrical installations are basic and advanced lighting plants, signaling plant, house phones plant, hotels/hospital plants, fire and intruder alarm plants, video intercom plant and a large number of installation kits with all the necessary accessories to make any need available. They are recommended for installers and high schools.

TWO PLACE WORK BENCH WITH 2 INDEPEN DENT SUPPLIES

DL 1101

FOUR PLACE WORK BENCH WITH 4 INDEPENDENT SUPPLIES

FOUR PLACE WORK BENCH WITH 2 INDEPENDENT SUPPLIES

TWO PLACE WALL WORK BENCH WITH 1 SUPPLY

DL 1106

SINGLE PLACE BENCH-TOP WORK FRAME WITH 1 SUPPLY

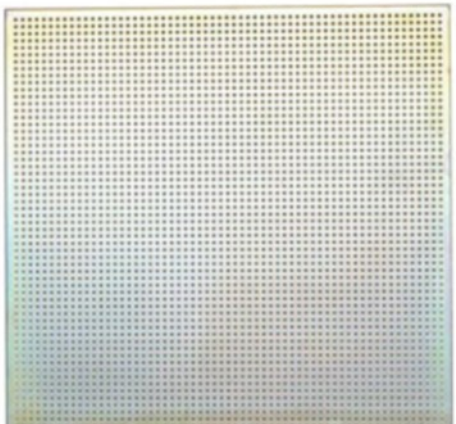
WOODEN PANEL

DL 1100B

TWELVE JUNCTION BOXES PANEL

DL 1100C

SIX JUNCTION BOXES PANEL



GRID PANEL

DL 1100D

STRIP PANEL

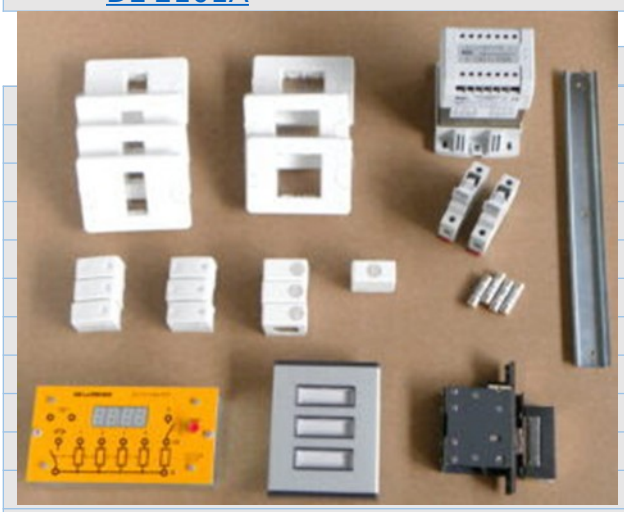
DL 1100E

CIVIL INSTALLATIONS

DL 2101

LIGHTING INSTALLATIONS

DL 2101A



SIGNALING INSTALLATIONS

DL 2101B

INTERCOM SYSTEM KIT

DL 2101C

HOTEL SIGNALING SYSTEMS

DL 2101D

CIVIL AND HOTEL INSTALLATION SYSTEMS

DL 2101E

1

2

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This is why we are constantly looking at developing new products

and finding better solutions.

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AUTOTRONICS

Autotronics is an area of engineering in which the knowledge of micro-electronics, telematics, robotics and informatics is applied in the automotive sector. It studies everything that is operated by sensors and electrical systems in a vehicle, allowing greater interaction with the user.

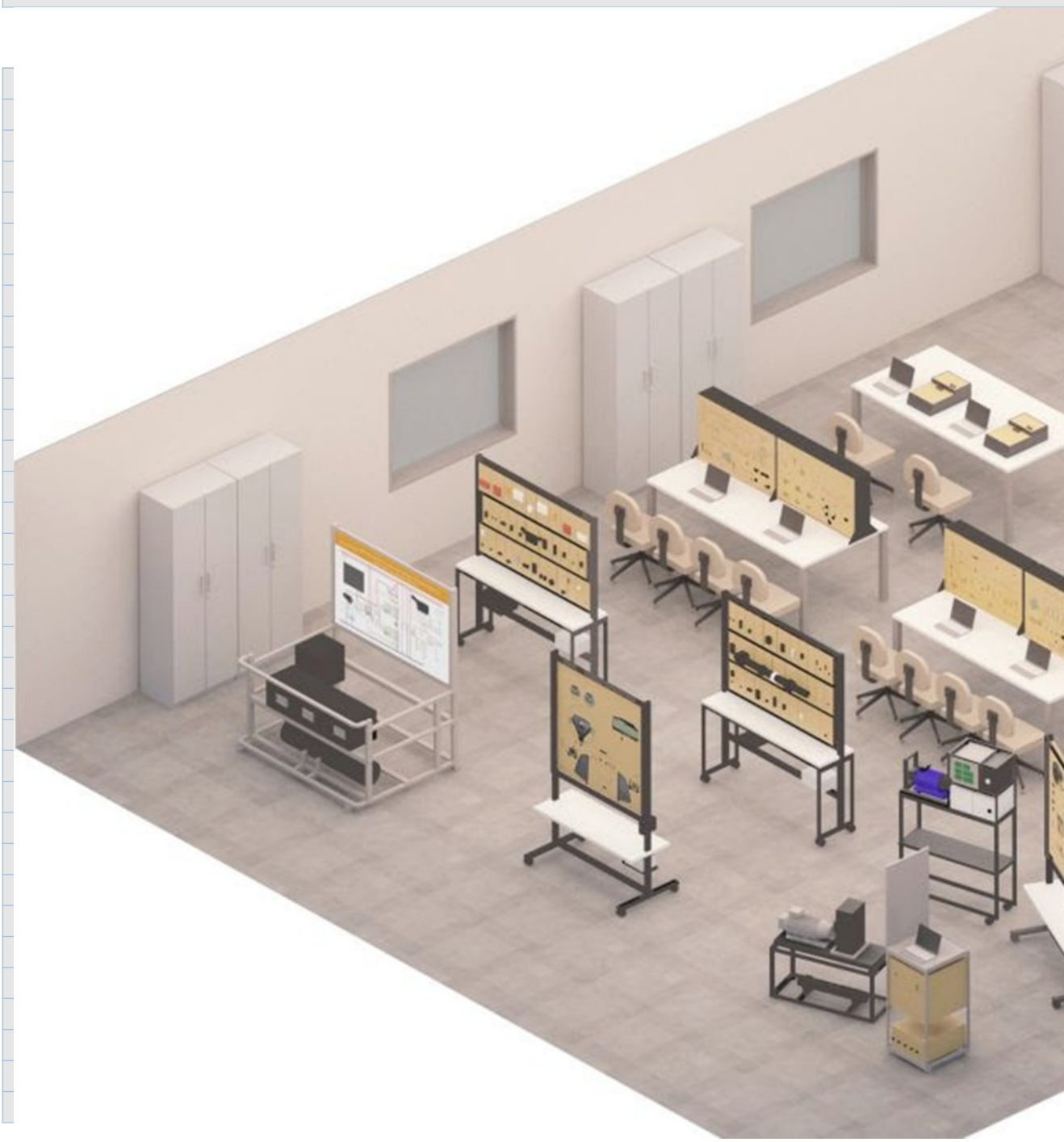
Its main function is to improve the safety and comfort of automobiles through technology. Among the latest contemporary trends we find electric cars and autonomous vehicles.

The professional skills that you can develop with our Autotronics equipment are:

- Identifying the technical characteristics of equipment and components, vehicles and automotive systems.
- Identifying measurement and communication devices, as well as automotive vehicle test points, considering established procedures.
- Knowing the sensors and actuators in automotive systems, considering their type and technical specifications.
- Diagnosing failures in vehicles and automotive systems, handling measuring equipment and instruments.
- Maintaining the electrical and electronic systems of automotive vehicles, using cutting-edge technologies for their diagnosis.

Maintaining the air conditioning and cooling systems of automotive vehicles, using cutting-edge technologies for their diagnosis.

Knowing the systems of hybrid vehicles, considering their type and the procedures necessary for their maintenance.



SOLUTION LABORATORY FOR AUTOTRONICS
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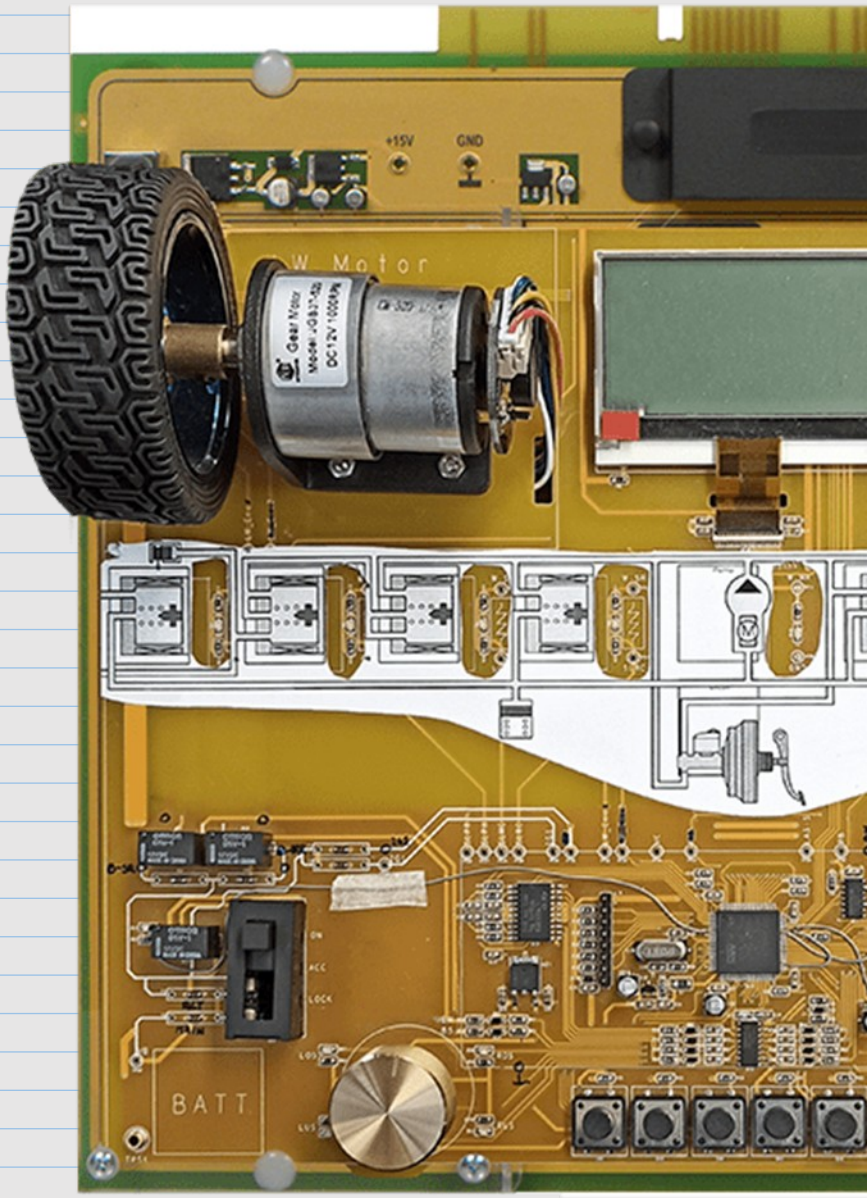


TIME PLATFORM SYSTEM

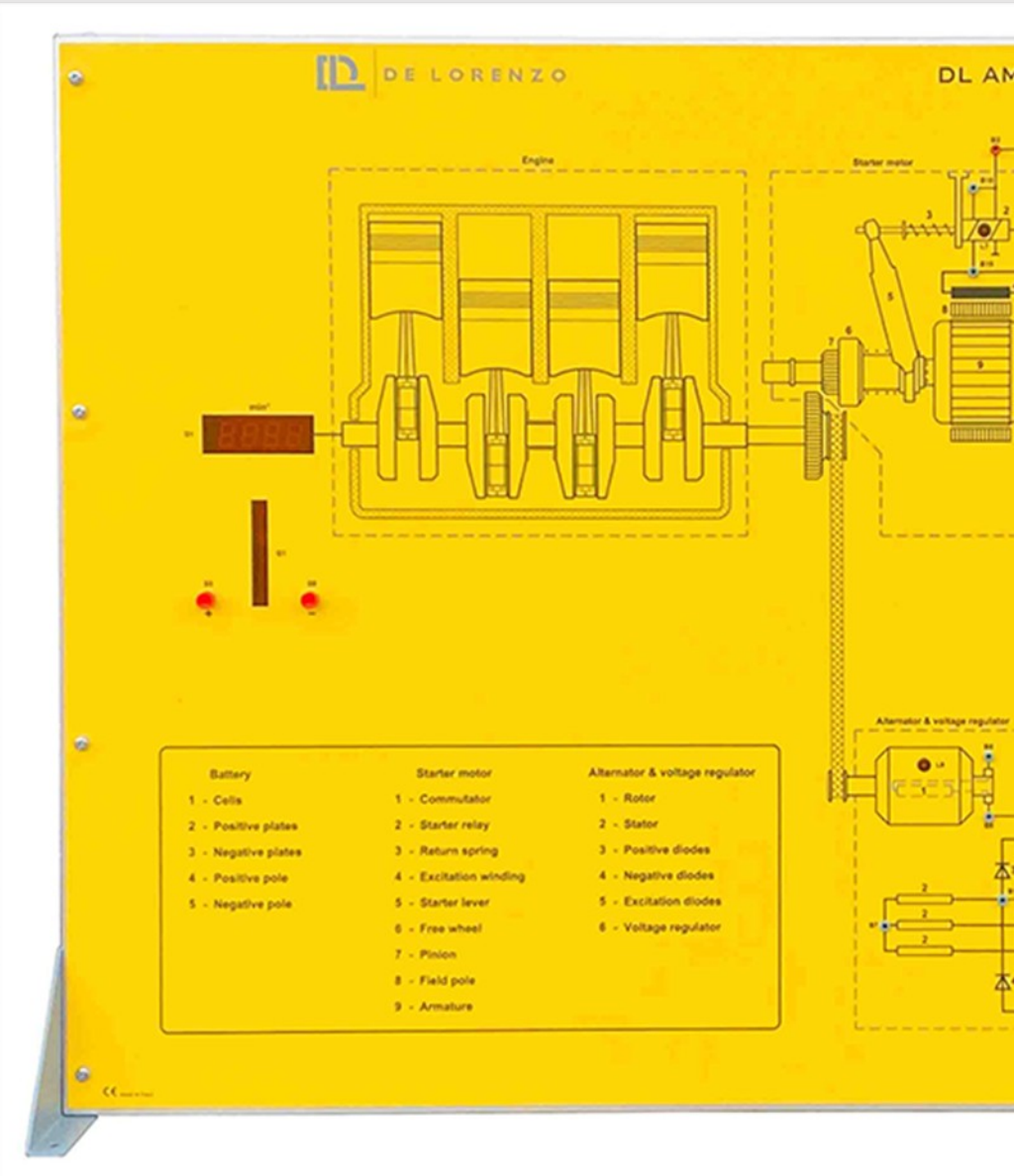
The TIME (Trainer for Interactive Multipurpose Electronics) system is a trainer for interactive multi-theme electronics. TIME workstations are a platform for guided learning and self-learning at 360 degrees. With these study boards, the teacher can cover practically all the curricular subjects of the study of electronics, ranging from the basic concepts of electricity and electromagnetism, DC an...

Read more

ADVANCED TRAINERS

DE LORENZO demonstrators allow the student to access the model of a real system in a real way and sometimes at scale, as well as to carry out experiments with it, so that studens can understand its behavior or generate evaluation processes of procedure and practices.

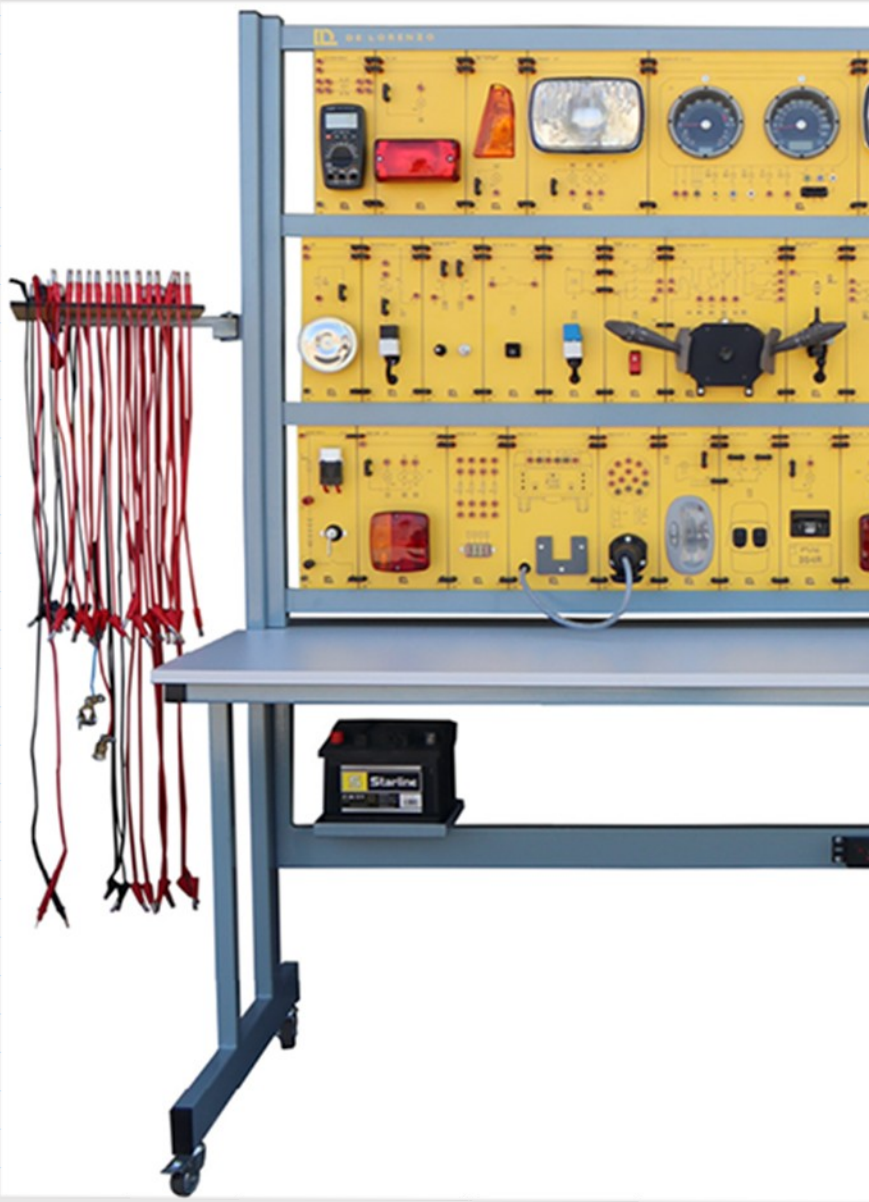
Read more



IGNITION

Vehicle ignition systems has evolved significantly over the years to deliver improved, more reliable and more powerful performance. The purpose of the ignition system is to generate a very high voltage from the car’s 12V battery, and to send this to each sparkplug in turn, igniting the fuel-air mixture in the engine’s combustion chambers. The coil is the component that produces this high voltage...

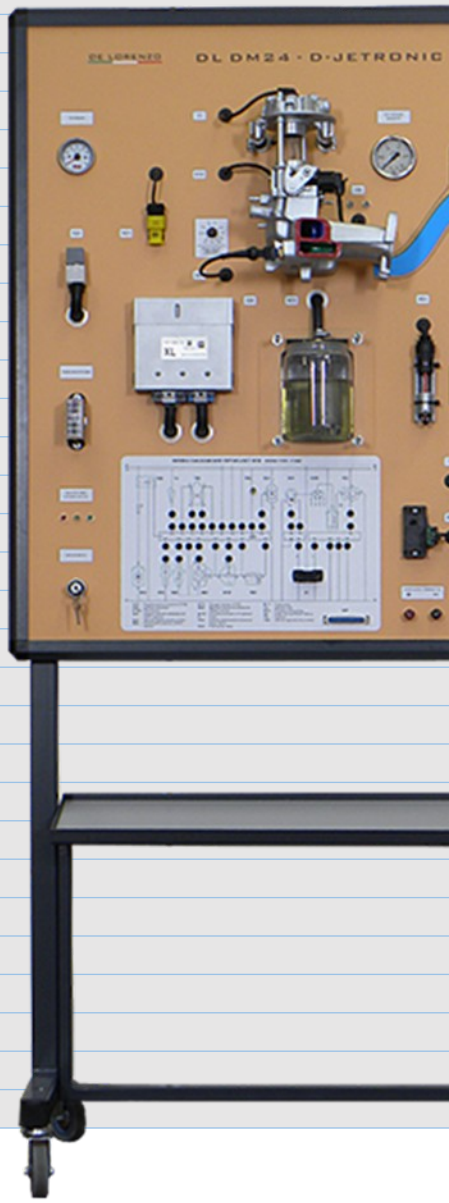
Read more



ELECTRIC CIRCUITS / PLANTS

Vehicle electrical systems were relatively simple, containing just a few circuits for lighting, wiper and heater motors, and a points-type ignition system. The last years witnessed exceptional advances in electronics technology, which brought about a remarkable growth in the function of the electrical system so that a rapid increase in the number and complexity of electrical modules incorporated...

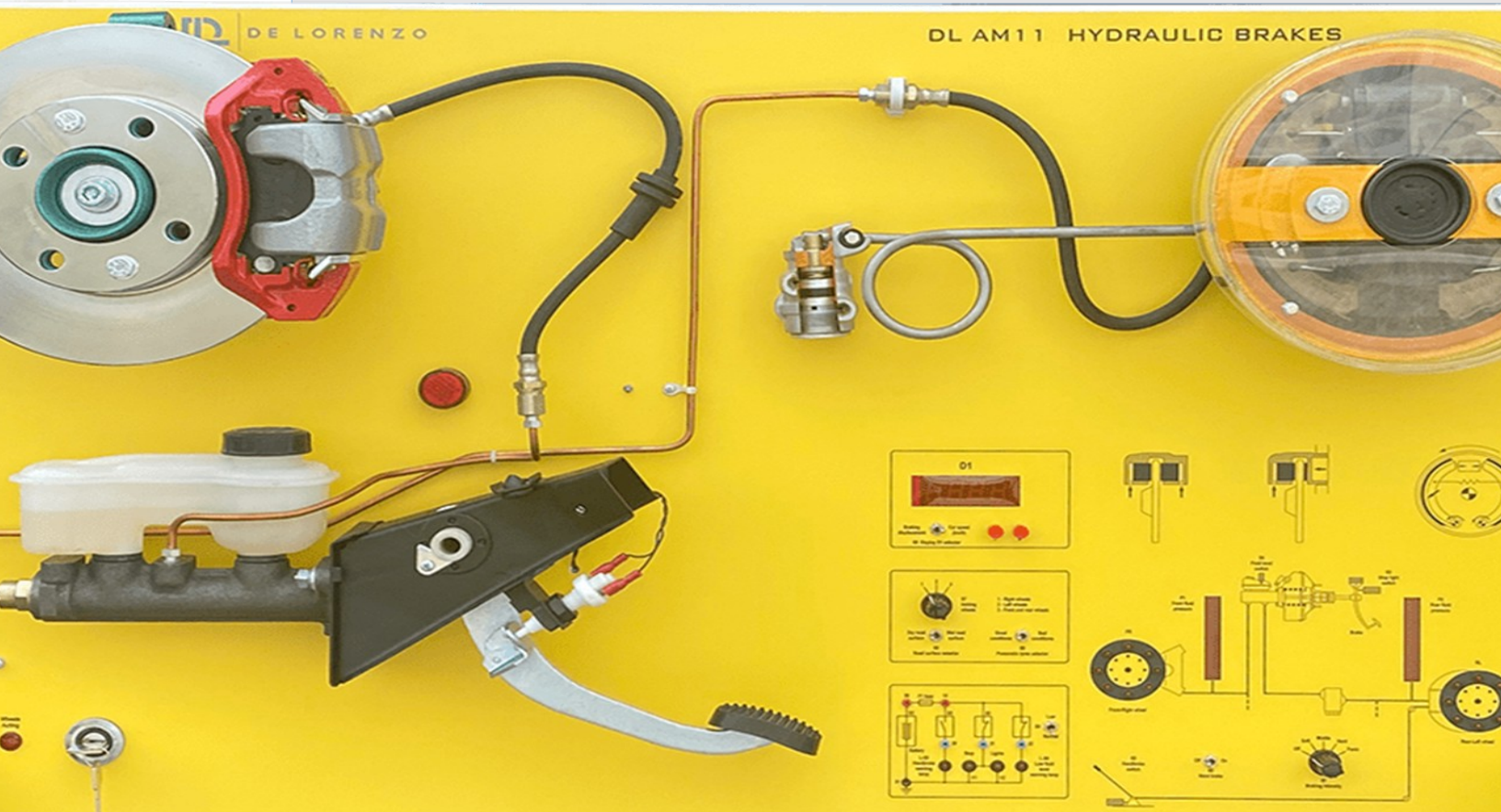
Read more



ENGINE OPERATION

Internal combustion engine produces mechanical power from the chemical energy contained in the fuel, because of the combustion process occurring inside the engine. Approximately 30% of the energy released in an internal combustion engine is converted into work and the remaining energy is lost in the form of heat and friction in the engine. The mechanical energy is usually made available on a rota...

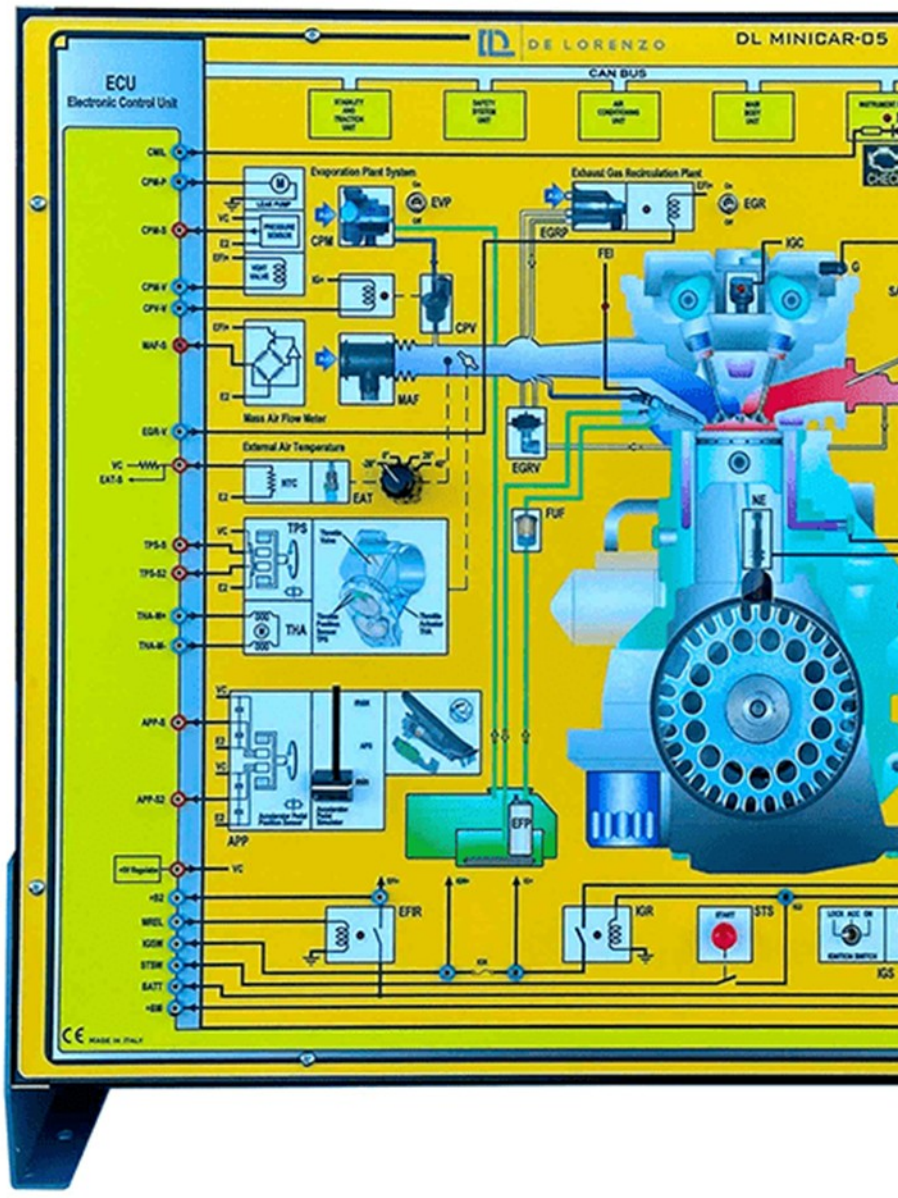
Read more



BRAKING

The automobile brake system is the most important in vehicles. In addition, it is an essential element to measure the performance of an automobile that affects the other properties of the vehicles. It is a mechanical device that inhibits motion by absorbing energy from a moving system to slow down or to stop a moving vehicle, most often accomplished by means of friction to convert the kinetic ene...

Read more



EMISSIONS CONTROL

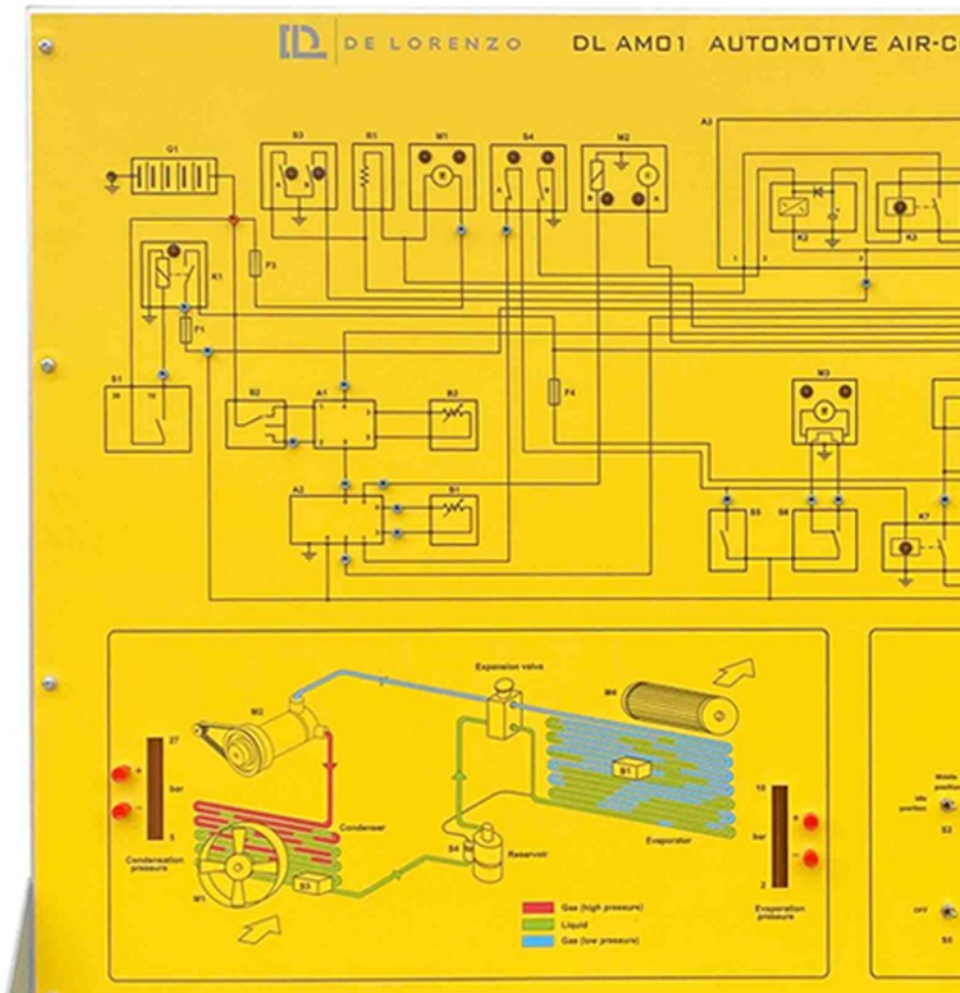
Vehicle emissions control is the study of reducing the motor vehicle emissions produced especially in internal combustion engines. Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment. The principal pollutants include hydrocarbons (HC), carbon monoxide (CO), oxides from nitrogen NOX (NO + NO2), sulfur oxide (SOX) and vol...

Read more

SAFETY

Constantly evolving vehicles have created the need for more car safety features than vehicles of the past. As cars become faster and more efficient, they must also become safer. Drivers are protected by more car safety features than ever, including shatter resistant glass (providing a windshield that breaks into numerous, harmless pieces in the event of an accident), seatbelts, airbags, anti-lock...

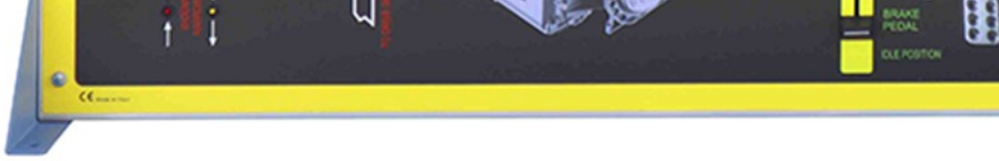
Read more



CONDITIONING

Air conditioning like it says “conditions” the air. It not only cools it down, but also reduces the humidity. All air conditioners work with the same way whether they are installed in a building, or in a car. The air conditioning in the car reduces the number of kilometers per liter because there is energy used in removing the heat and moisture from the air inside, and this consumes petrol becaus...

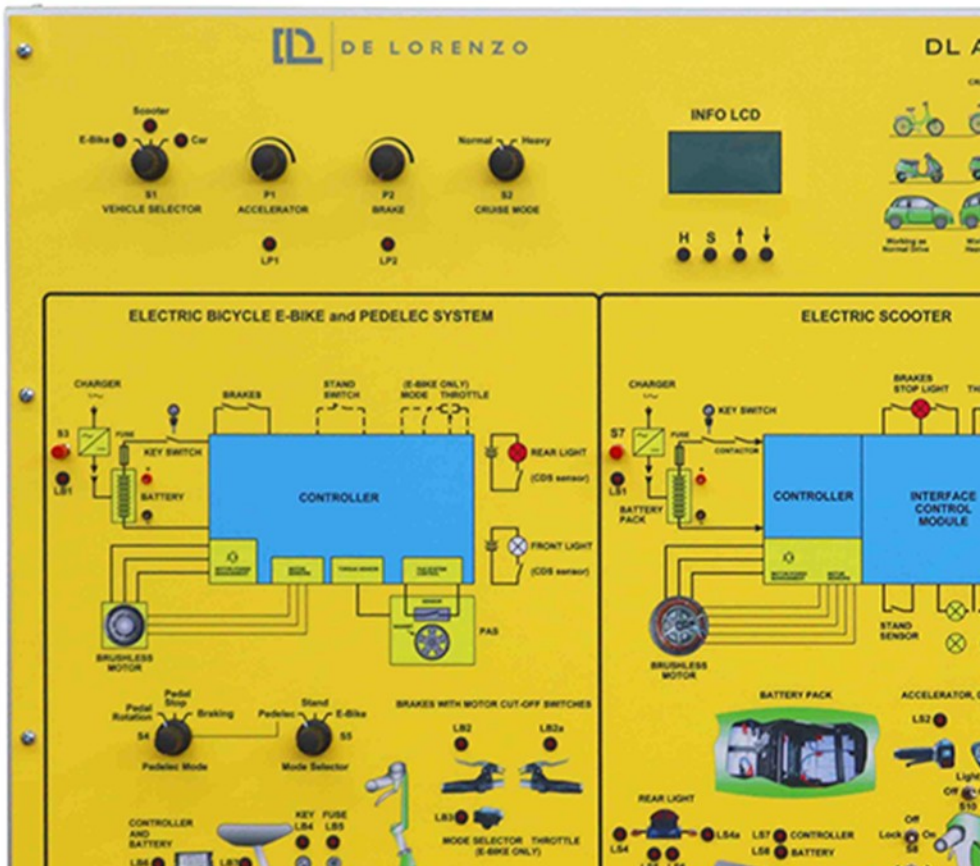
Read more



HYBRID VEHICLE

A hybrid vehicle is one that uses more than one means of propulsion, which means combining an Internal Combustion Engine (ICE – petrol or diesel) with an electric motor. Its main advantages are that it should consume less fuel and emit less CO2 than a comparable conventional petrol or diesel-engined vehicle. The electric engine powers the car at lower speeds and gas engine powers it at higher spe...

Read more



ELECTRIC VEHICLE

An Electric Vehicle, also called EV, uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity. Just as there are a variety of technologies available in conventional vehicles...

Read more

INDUSTRIAL VEHICLES

The diesel engine is an internal combustion engine in which ignition of the fuel which is injected into the combustion chamber is caused by the elevated temperature of the air in the cylinder due to mechanical compression. Diesel engines work by compressing only the air and contrasts with spark-ignition engines such as petrol engine or gas engine, which use a spark plug to ignite an air-fuel mixt...

Read more

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This is why we are constantly looking at developing new products

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ls with innovative topics such as electric cars and autonomous vehicles, placing itself at the centre of the technological challenges of the future.

De Lorenzo’s teaching solutions are developed to enable students to develop fundamental skills to fully understand automotive systems, learning how to identify technical components and measuring instruments, diagnose faults and carry out maintenance on electrical, electronic and air conditioning systems. In addition, the students will be able to work with advanced technologies to address the maintenance of hybrid vehicles and explore innovative solutions for the industry. **This course trains professionals capable of responding to the needs of a constantly evolving market, helping to improve the efficiency, sustainability and safety of future vehicles.**

- Ignition
- Engine Operation
- Safety
- Electric Circuits
- Hybrid Vehicle
- Braking
- Conditioning
- Electric Vehicle

Height from ground to work surface: 90 cm.

AUTOTRONICS

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BRAKING POWER CONTROL

DL 3155A05

The design and construction of electronic circuits to solve practical problems is an essential technique in the fields of electronic engineering and computer engineering.

With this board, the students can learn about the operation of the braking power control implemented in ABS (Anti-Lock Braking System), ASR (Anti-Slip Regulation) and ESP (Electronic Stability Program) car systems.

The board includes two wheels driven by two electrical motors representing the front wheels of a car.

An ECU reads the system variables in real time (such as vehicle speed and braking power) and controls the simulated pump and solenoid valves. The values are accessible through test points and an LCD display.

A scantool OBD-II is integrated in the system to troubleshooting functions.

THEORETICAL TOPICS

The Braking Systems:

- The traditional braking system
- ABS / ASR / ESP Braking Systems

System operation:

- The hydraulic circuit
- Pressure increase mode
- Pressure maintenance mode
- Pressure reduction mode

The Electric Circuit:

- Battery, Ignition Switch
- ABS control unit

Sensors and Actuators:

- Rotation speed sensors
- Pump and solenoids

Diagnostics Trouble Codes OBD-II

COMPONENTS

- Two wheels with DC driving motors €
- Rotation sensors on each wheel €

• Vehicle speed and braking setting potentiometers	€
• Potentiometer for steering wheel simulation	€
• ABS / ASR / ESP control unit with 32-bit microcontroller	€
• Braking control solenoid valves	€
• Pump control device	€
• Battery and Ignition Switch	€
• LCD display and keyboard	€
Complete with theoretical and practical manual.	
Dimensions of the board: 297x260mm	

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CAI SOFTWARE:

Each board of the TIME system can be supplied complete with a Student Navigator software that allows students to perform their learning activities through a Personal Computer, without the need for any other documentation.

Ordering code: please add SW after the code of the board (i.e. DL 3155A05SW)

Required:

POWER SUPPLY NOT INCLUDED

Base frame with power supply (completed with connecting cables):

➢ **DL 3155AL3** - Base frame with power supply and interface to pc and virtual instrumentation	
➢ **DL 3155AL2** - Base frame with power supply and interface to pc	

Basic power supply (connecting cables not included):

➢ **DL 2555ALG -** DC power supply ±5 ±15 Vdc, 1A

➢ **TL 3155AL2 -** Connecting cables

Choosing this power supply, for the execution of the experiments, it is normally required the use of an oscilloscope and two multimeters.

AUTOTRONICS - MODULES

On Fri, Aug 1, 2025 at 2:05 PM TSHINGOMBEKB TSHITADI <tshingombekb@gmail.com> wrote:

-

INDUSTRY 4.0

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EQUIPMENT SYSTEM FOR THE STUDY OF INDUSTRY 4.0 “SMART

FACTORY” ENHANCED WITH ARTIFICIAL INTELLIGENCE

DL I4.0 FACTORY-AI

Industry 4.0 (**I4.0**) and Artificial Intelligence (**AI**) are revolutionizing the manufacturing sector by

integrating advanced technologies to create "**smart factories**”.

The digitization of information, combined with high-performance hardware and **AI** technologies,

enables the implementation of more flexible and optimized production architectures. The level of

innovation is such that today, **Industry 4.0** is synonymous with intelligent manufacturing, and the

adjective "**smart**" refers to integrated information management, enhanced by **AI** and digital

technology.

This proposed educational system reproduces a collaborative environment to study concepts related

to **Industry 4.0** enhanced with **AI**, integrating small-scale subsystems commonly found in a

manufacturing plant. It is composed of a set of electronic boards, real hardware simulators and

software to study the different subsystems that can be found in a real production line. The students,

using an open-source microcontroller connected to **SCADA** (**S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition)

software for data acquisition, will be able to perform activities covering topics on introduction to

automation and robotics, communication protocols (**IoT**), sensors and actuators and complete study

of a productive system related to **Industry 4.0**.

The added **DL AI-MODULE** to this system uses the **SCADA** data to enhance operational efficiency

across key areas. It predicts equipment failures with predictive maintenance, detects real-time

anomalies, optimizes production processes, automates quality control, forecasts energy consumption,

and improves supply chain management.

In today’s rapidly evolving industrial landscape, leveraging data to enhance operational efficiency and

predict potential issues is crucial for maintaining competitive advantage. The **DL AI-MODULE** focuses

on the application of advanced data analytics and artificial intelligence (**AI**) to optimize various aspects

INDUSTRY 4.0

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of production and operational processes. By analyzing historical and real -time data, the module helps

organizations reduce costs, minimize waste, and maintain high performance.

The system has the following main characteristics:

- The students will familiarize with the different parts that make up a real industrial process and the

€

corresponding concepts gradually, starting from the study of basic hardware until the practical

realization of a scale production line providing them with hands-on training based on experiments.

- The training is organized by levels ranging from the most basic concepts of electronics and

€

automation to the simulation of an industrial process applying industry 4.0 concepts into practice.

• It is possible to study each subsystem independently or linked together for the simulation of a	€
complete production line. The systems that comprise a 4.0 factory include at least RFID, robotic	
arm, conveyor belt and a semi-automatic warehouse being on scale for placing on benches or	
desks in the laboratory.	
• It is reconfigurable and modular and has a platform suitable for project development.	€
• The entire system is controlled by an industrial SCADA software that communicates with all the	€
subsystems and shows the data from the sensors, the status, and the system control, in real time.	
The learning platform is based on structured software, open and customizable, so the students	
are able to develop applications using programming and control techniques.	
• Supervision and control interface are remotely accessible.	€
• It is possible to simulate real scenarios and develop analytical and problem-solving skills at various	€
levels such as:	
-	
Circuit theory.	
-	
Programming fundamentals.	
-	
Sensors and actuators.	
-	
Study of communication protocols, RFID, Bluetooth, IoT.	
-	

Automation and control theory.

-

Microcontrollers.

The laboratory includes the following modules:

- **DL 3155BRS-RFID** - RFID protocol study board. €
- **DL ROB-SIM** - Kit for the study of a robotic arm. €
- **DL CIM-SIM** - Kit for the study of a conveyor Belt. €
- **DL WMS-SIM** - Kit for the study of a warehouse. €
- **SCADA software** and connection kit. €
- **DL AI-MODULE** – Artificial Intelligence and key benefits. €

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DL 3155BRS-RFID - RFID protocol study board

This board allows to study the properties of an RFID system and all components necessary to develop

a door access control system. The students can interact with the hardware in a simple way through

software explaining step-by-step the operation of the system. The integration of the RFID elements in

an industrial process is possible using a SCADA software for the study of automation and industry 4.0

concepts.

This base board includes built-in power supply, providing all the voltages necessary for its operation,

with the following circuit mini boards: real time clock, LCD display, RFID reader/writer, transponder,	
audio speaker, relay, tag receiver, keyboard, microcontroller.	
The students can perform the following activities:	
• Behaviour of the reader when a tag is identified.	€
• How to read data from proximity integrated circuit card using a RFID reader.	€
• How to read and write data blocks on a MIFARE proximity integrated circuit card.	€
• How to write and how to read personal data to a MIFARE proximity integrated circuit card	€
using an RFID reader.	
• How to activate a relay using the outputs of the microcontroller.	€
• How to control a display and a real time clock by using the microcontroller.	€
• How to connect a keypad to a microcontroller.	€
• Simulation of a door access control system.	€

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DL ROB-SIM - Kit for the study of a robotic arm

Consisting of simulator and electronic boards, for the study of the properties and control techniques

of a 5-axis robotic arm used in industrial environments. They include sensors and actuators so as to

develop a complete course on robot control systems. The students can interact with the hardware in

a simple way through software explaining step-by-step the operation of the system.

It is composed of the following:
• Collection of boards to study the hardware characteristics and the control techniques of a €
robotic system through an open-source microcontroller. The sub-boards include all the
components, sensors and actuators needed to develop an educational robotic arm.
It includes a base board with built-in power supply, providing all the voltages necessary for its
operation with the following circuit mini boards: joystick, LCD display, servo-motor, ultrasonic
sensor, flex sensor, gyroscope, Bluetooth, microcontroller.
The students can perform the following activities:
-
Characteristics of a joystick controller and interface with the microcontroller.
-
Study of a servomotor and its controller.
-
Introduction to the Bluetooth standard and implementation of a Bluetooth interface with
the microcontroller.
-
Analysis of a flex sensor and its interfacing with the microcontroller.
-

Study of an ultrasonic proximity sensor.
-
How to control an LCD display through I_2C communication interface.
-
How to measure orientation and angular velocity using a gyroscope.
-
Basic control techniques: controlling a servo using a joystick and displaying servo position
on an LCD display.
• Real hardware simulator of a 5-axis robotic arm used in an industrial environment to learn €
how to operate a robotic arm through a programmed microcontroller. It allowsthe connection
with the board kit components, making them compatible with each other.
It has the following technical characteristics:
-
Power supply: 90V-230V ±10%, 50/60Hz.
-
Angle/distance range: 1° axis: 180°, 2° axis: 180°, 3° axis: 180°, 4° axis: 180°, 5° axis: 180°,
6° axis: gripper opening (max. 55 mm).

INDUSTRY 4.0

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-

Servo specifications: dimensions (approx.): 40 x 18 x 40 mm, operating speed (approx.):

0,17 ÷ 0,13sec / 60 grades (4,8 ÷ 6,0 V with no load), stall torque (approx.): 13 ÷ 15 kg-cm

a 4,8/6 V, operating voltage: 4,8 ÷ 7,2V.

-

Compatible with Arduino UNO boards, indicatively ATmega328 processor, 32KB flash

memory, 1KB EEPROM memory, 2KB SRAM memory, 23 general purpose I/O ports.

-

RFID detector.

-

Interfacing with SCADA monitoring software.

The students can perform the following activities:

-

Study of the robot components.

-

Arm control in real time using a joystick.

-

Step-by-step movement programming.

-

Movements recording.

-

Controlling position using a gyroscope.

-

Bluetooth communication for remote control.

INDUSTRY 4.0

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DL CIM-SIM - Kit for the study of a conveyor belt

Consisting of simulator and electronic boards, for the study of the properties and operation of a

conveyor belt used in industrial environments. They include sensors and actuators so as to develop a

complete course on main features of conveyor systems and its applications.

The students can interact with the hardware in a simple way through software explaining step-by-step

the operation of the system.

It is composed of the following:

- Collection of boards to study the hardware characteristics and the control techniques of a

€

conveyor belt. The sub-boards include all the components, sensors and actuators needed to

understand and manage the operation of a conveyor belt.

It includes a base board with built-in power supply, providing all the voltages necessary for its	
operation, with the following circuit mini boards: LCD display, DC driver motor, DC motor,	
BRS inputs, seven segment, stepper motor, IRD sensor, RGB sensor, microcontroller.	
The students can perform the following activities:	
-	
How to control an LCD display through a microcontroller.	
-	
Monitoring an infrared positioning system and of a RGB sensor.	
-	
How to control a DC motor through a power driver - a stepper motor - a seven segment	
LCD display.	
• Real hardware simulator of a conveyor belt unit used in a real industrial environment to learn	€
how to operate and to control production line by using a PLC (included in the system) and an	
open-source microcontroller.	
The students can perform the following activities:	
-	
How to control a conveyor belt through a push button panel.	

-

Using a PLC to control the conveyor belt movement.

-

How to control and identify a processed item on the conveyor belt.

-

How to monitor the position of an item placed on the conveyor belt.

-

Identifying and verifying the colour of an item.

-

Identifying a scrap part and placing it in the correct position.

-

Generating a process report.

-

Interfacing with SCADA monitoring software.

INDUSTRY 4.0

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DL WMS-SIM - Kit for the study of a warehouse

Consisting of simulator and electronic boards, for the study of a semi-automatic warehouse found in	
industrial environments. They include sensors and actuators so as to develop a complete course on	
main features of a semi-automatic warehouse and its applications.	
The students can interact with the hardware in a simple way through software explaining step-by-step	
the operation of the system.	
It is composed of the following:	
• Collection of boards to study the hardware characteristics and the main features of a semi	€
automatic warehouse. The sub-boards include all the components, sensors and actuators	
needed to understand the operation of a semi-automatic warehouse.	
It includes a base board with built-in power supply, providing all the voltages necessary for its	
operation, with the following circuit mini boards: LCD display, weight sensor, distance sensor,	
temperature, and humidity sensor, PID controller, keypad, temperature-humidity cycle,	
EEPROM, microcontroller.	
The students can perform the following activities:	
-	
How to control an LCD display through a microcontroller.	
-	

Monitoring a weight sensor, external temperature, external humidity, a distance sensor.
-
Implementing a closed loop ON-OFF controller and a closed loop PID controller for a
temperature-humidity cycle.
-
Interfacing a keypad to a microcontroller.
-
Data storage on the external memory device.
• Real hardware simulator of a semi-automatic warehouse used in a real industrial environment €
to learn how to operate and control a semi-automatic warehouse. It allows the connection
with the board kit components, making them compatible with each other.
The students can perform the following activities:
-
Identification and weight of an item.
-
Manually assign a position to an item.
-
Automatically assign a position to an item.
-
Automatic inventory update.

-

Manually and automatically picking an item from warehouse.

-

Interfacing with SCADA monitoring software.

INDUSTRY 4.0

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SCADA software and connection kit

It controls the whole system, communicating with all the trainer subsystems and shows the data from

the sensors, the status, and the system control, in real time. This software offers a structured learning

platform where all the theoretical elements and practices necessary to address the proposed topics

can be found. Open SCADA-WEB license allows the students to create their own projects and

customize them showing the parameters of interest, generating automatic reports, and controlling

the actuators for an "intelligent" management of a productive process. It is possible to use the

software to remotely monitor the system from a local or remote PC using an internet connection.

It is composed of the following:

- USB/RS485 serial Modbus RTU communication interface. €
- SCADA software and license. €

INDUSTRY 4.0

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Through the supervision system, all the above sub-stations, composing the educational system for

Industry 4.0 are able to exchange data and display information relevant to the process.

The software is structured to follow a simulated manufacturing process receiving input from the user

and generating report files that are accessible remotely.

The processes implemented in the software include the following:

-

Processing an order from a client.

-

Generating a production order.

-

Generating a purchase order.

-

Manage and update different BOMs.

-

Supervise the production process.

-

Manage inventories.

-

Creating packing lists.

All the historical data relevant to the production process is logged into the RFID tag of the

manufactured object for product traceability.
DL AI-MODULE – Artificial Intelligence and key benefits
By utilizing historical and real-time data gathered through SCADA systems, the following sections
outline the key exercises, objectives:
PRACTICE
OBJECTIVE
DATA
Predictive
Maintenance
Develop models to predict equipment
failures or maintenance needs before
they occur.
Historical operational data
and SCADA system error
logs.
Real-Time Anomaly
Detection
Identify unusual patterns or anomalies
in real-time data that could indicate
potential problems or inefficiencies.
Real-time data flows from
SCADA-monitored
equipment.
Production Process
Optimization
Optimize production processes to
improve efficiency and reduce waste.
Data from various stages of
the production cycle
managed by SCADA.
Quality Control
Automation
Automate the quality control process
using AI to ensure consistent product
standards.
Data related to product
measurements and test

results collected by SCADA.
Energy Consumption
Forecasting
Forecast energy consumption to better
manage energy use and reduce costs.
Historical energy usage data
from SCADA.
Supply Chain
Optimization
Improve supply chain efficiency by
predicting demand and optimizing
inventory levels.
Data related to order
processing and inventory
levels from SCADA.

Gmail

(no subject)

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ARTIFICIAL INTELLIGENCE

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LABORATORY FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE

DL AI-2.0 & DL AI-2.0SW

DESCRIPTION

This didactic laboratory **DL AI-2.0** for the development of **Artificial Intelligence** solutions is a state-of-the

art platform designed to provide practical and complete experience in the development of Artificial

Intelligence solutions. With software and hardware that allow students to illustrate real-life scenarios,

they will develop a comprehensive understanding of problem-solving from an **AI** perspective.

The laboratory **DL AI-2.0** is mainly composed of a system with hardware modules with the support of a

Server on which all the software related to **AI** field is installed. **Three** students can work on it performing

all the experiments and the proposed training objectives with the help of the provided software’s as listed

at the end of this catalogue in “**SOFTWARE APPLICATIONS**” & “**TRAINING OBJECTIVES**”. Even the three

students who work with the HW need their own PC.

With this laboratory

20

students can

work simultaneously [

3

on the

hardware and up to

17

on computer

equipment (not included)].

Teachers can perform more than

20

experiments.

Who is it for?

- Artificial Intelligence Engineering
- Automation Engineer
- Software Engineer
- Mechatronics Engineering
- Process Engineering
- Information Technology
- Technical and Professional Training

Programming Fundamentals

Algorithms and data structures

Algorithm analysis and design

Programming Paradigms

Databases

Digital and analog signals

Fundamentals of Artificial Intelligence

Web development technologies (oriented to background communication)

Digital image processing

Machine learning

Machine vision

Bio-inspired algorithms

Natural language technologies

Neural networks and deep learning

Software engineering for intelligent systems

High level

communication

protocol

ARTIFICIAL INTELLIGENCE

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This lab also allows to increase the student’s number, up to **17** (becoming **20** students total), to work on

it **at the same time** (with access to the Server from their own PCs) by providing a single license each.

This additional license (when and if needed) has the following code **DL AI-2.0SW**.

Please refer to other suggested configurations at the end of this catalogue.

PEDAGOGICAL APPROACH

In the didactic laboratory for the development of Artificial Intelligence solutions, the challenge-based
learning (CBL) approach focuses on providing students with practical, real-world challenges that allow
them to apply theoretical knowledge in specific situations. Rather than simply presenting information
passively, this approach engages students in solving problems and creating innovative solutions.
Students are faced with challenges that simulate real-life and industry problems, such as process
optimization, anomaly detection or efficiency improvement. Using the hardware and software available

in the lab, as well as artificial intelligence tools, students work in teams to develop practical solutions that

address these challenges.

MAIN CHARACTERISTICS

• **Multidisciplinary:** Useful for the study of software development, artificial intelligence.

• **Economic:** By involving several disciplines, the cost of the product can be divided among different

departments.

• **Open:** Provides the architecture to implement standard and new solutions, allowing the use of the

product in professional and research activities.

• **State-of-the-art:** The product provides a descriptive view of software architecture for *development*

using artificial intelligence.

MAIN DIDACTIC CONCEPTS
-
AI basics.
-
Machine Learning (ML).
-
Sensors and actuators as data sources.
-
Data processing and analysis.
-
Programming and AI tools.
-
Industrial applications.
SIMULATED INDUSTRIAL CHALLENGES
-
Lighting management.
-
Quality control.
-
Process automation.
-
Detection.
-
Predictive maintenance.
-
Condition monitoring.
-
Optimization.

ARTIFICIAL INTELLIGENCE

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First Steam Engine:
James Watt Improves
on the Steam Engine,
Driving Automation in
the Industrial
Revolution.

1785

Ford Assembly Line:
Henry Ford introduces
the first mass assembly
line, revolutionizing
industrial production.

1913

ENIAC: The first
general-purpose digital
electronic computer is
built, paving the way
for computational
automation.

1946

First industrial robot
(Unimate): It is
installed in General
Motors to automate
repetitive tasks on the
assembly line.

1959

PLC (Programmable
Logic Controller): The

first PLC (Modicon
084) is created to
replace hardwired
logic circuits, allowing
greater flexibility in
industrial automation.
1969
Advanced robotics:
The use of robots is
becoming popular in
industry to perform
more complex and
repetitive tasks, such
as welding and
assembly.
1980
Deep Blue vs. Kasparov:
IBM's computer, Deep Blue,
defeats world chess
champion Garry Kasparov,
showing the potential of
artificial intelligence in
complex tasks.
1997
First "smart" factory:
Advanced automated
control and monitoring
systems with machine-to
machine communication
are implemented, a
precursor to the concept of
Industry 4.0. Siemens
(Amberg, Germany)
2000
Image recognition: The first
image recognition
technologies with
convolutional neural
networks are introduced,
allowing machines to
interpret images and
videos.
2001
IBM's Watson: Watson wins

in the Jeopardy! program,

demonstrating AI's ability to

process natural language

and make complex

decisions.

2011

Artificial Intelligence in

Industry 4.0: The use of AI

and machine learning to

optimize production

processes, predictive

maintenance and real-time

data analysis in

manufacturing is

consolidated.

2020

ChatGPT: ChatGPT is

launched based on OpenAI's

GPT-3 architecture,

revolutionizing natural

language processing and

human interaction with

machines using advanced

generative models.

2022

WHO IS IT FOR?

Schools, Academia and Industry (to validate theory and test concepts):

-

Automation Engineer

-

Software Engineer

-

Mechatronics Engineering

-

Process Engineering

-

Information Technology
-
Technical and Vocational Education and Training (TVET)
INTRODUCTION TO AUTOMATION 4.0 AND ARTIFICIAL INTELLIGENCE
Industry 4.0 is now a reality, revolutionizing production facilities around the world. To fully exploit its
potential, technicians with expertise in software engineering and automation are increasingly essential, and
professionals with interdisciplinary skills are needed more than ever, Industry 4.0 thrives on the generation,
storage, analysis and application of data for decision making, which requires specialized software.

Technicians must understand software engineering to manage systems and automation engineering to

understand industrial architectures and optimize the use of data. In this context, Artificial Intelligence (AI) is

beginning to transform industrial processes by addressing needs that were traditionally met with sensors and

human intervention. Although AI is poised to replace certain algorithms and sensors, this change is limited

by the shortage of professionals who can bring together automation and software to develop Artificial

Intelligence (Machine Learning, Neural Networks, etc.) for industrial applications, *The laboratory for the*

development of artificial intelligence (the product) aims to close this gap by training software engineers with

essential knowledge of automation and mechatronics, and vice versa.

ARTIFICIAL INTELLIGENCE

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ELEMENTS THAT COMPOSE IT

The laboratory constantly

generates readings on the

sensors, the information is

integrated into the database.

Students connect and extract

the information from the

database, creating different AI

models and using the

information from the DB, also

from the sensors, they can

interact directly with the

actuator panel to verify the

result created in the AI.

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ELEMENTS THAT COMPOSE IT

IoT MODULE (NodeMCU)

- They promote learning of key concepts of electronics, IoT, automation, and embedded

programming and AI.

• They facilitate the connection and testing of analog and digital sensors (temperature, humidity,
light, proximity, etc.).
• They use banana terminal blocks to facilitate wiring without the need for soldering.
• They provide learning about ADC/DAC converters.
• They provide knowledge on Microcontroller programming.
• They us GPIO control for reading inputs and outputs.
• They use PWM signal generation.
• They use interrupts for real-time events.
• They use MQTT and HTTP protocols for communication.
• They create Wi-Fi sensors.
• They use actuator control.
• They facilitate interaction with Node-Red environment.
• They facilitate implementation of AI models.

AI DEVELOPMENT MODULE (Jetson NANO NVIDIA)
• They promote learning of key concepts of electronics, IoT, automation, and embedded
programming and AI.
• They facilitate the connection and testing of digital sensors (temperature, humidity, light,
proximity, etc.).
• They use banana terminal blocks to facilitate wiring without the need for soldering.
• They provide learning about DAC converters.
• They support for I2C, SPI, and UART protocols.
• They support development in Python.
• They us GPIO control.
• They use PWM signals control.
• They support real-time event and outage handling.
• They support real-time image processing.

• They facilitate implementation of neural networks.
• They support computer vision.
• They support HTTP integration.
• They support interaction with Node-Red.
• They support interaction with DC Motor Control, Servos and Stepper Motor.
• They facilitate the use of LIDAR.
EMBEDDED DEVELOPMENT MODULE (ARDUINO MEGA)
• They promote learning of key concepts of electronics, IoT, automation, and embedded
programming and AI.
• They facilitate the connection and testing of analog and digital sensors (temperature, humidity,
light, proximity, etc.).
• They use banana terminal blocks to facilitate wiring without the need for soldering.
• They use Arduino IDE and C++.

- They us GPIO control.
- They use PWM signals control.
- They facilitate Interruptions for real-time events.

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- They support for I2C and SPI.
- They facilitate communication with other microcontrollers.
- They facilitate actuator control and automation.
- They facilitate interaction with LCD and OLED screens.
- They use with matrix keypads and LED matrices.

UDP SENSOR MODULE

- They collect essential data to train AI models.

• They provide real-time information for decision making.
• They simulate real-world conditions to solve practical problems.
• They connect the physical world with AI applications.
• They facilitate experimentation with different types of data.
• They allow to measure, monitor environmental variables.
• They help to understand the impact of AI on physical systems.
• They promote the integration of hardware and software in educational projects.
• They promote active learning through direct manipulation.
• They foster innovation by exploring new AI applications.
• They constantly feed the information into the database to perform exercises with historical
information.

• They provide real-time information to students who are not directly working in the device.
• They allow multiple exercises to be performed from an external computer.
DISPLAY MODULE
• They receive and deploy real-time information from UDP sensors.
• They allows the connection of multiple workstations for running software experiments.
• They keep the communication between the various environments synchronized.
SENSOR MODULE
• They collect essential data to train AI models.
• They provide real-time information for decision making.
• They simulate real-world conditions to solve practical problems.
• They connect the physical world with AI applications.

• They facilitate experimentation with different types of data.
• They allow us to measure, monitor and control environmental variables.
• They help to understand the impact of AI on physical systems.
• They promote the integration of hardware and software in educational projects.
• They promote active learning through direct manipulation.
• They foster innovation by exploring new AI applications.
ACTUATOR MODULE
• They transform AI decisions into physical actions.
• They allow tangible interaction with the environment.
• They demonstrate the applicability of AI in real systems.
• They facilitate the validation of AI predictions and models.

- They teach how to automate processes through AI.

- They simulate practical solutions to industrial problems.

- They convert processed data into useful answers.

- They integrate theoretical learning with visible results.

- They encourage creativity in the design of intelligent systems.

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- They drive understanding of the impact of AI on automation.

POWER SUPPLY MODULE

- Universal voltage input: Compatible with 110-240Vac and 50/60Hz.

• Regulated outputs: Provides 5V and 3.3V DC simultaneously.
• Current capacity: Supports up to 2A per output.
• Overload protection: Prevents damage due to overcurrent or short circuits.
• Compact design: Easy integration into prototypes or assembled systems.
• Standard connectors: Screw terminals and pins for easy connections.
• LED indicators: Displays real-time power status.
• Energy efficiency: Reduces energy loss during conversion.
• Compatibility: Ideal for powering microcontrollers such as Arduino, NodeMCU and sensors.
• Easy mounting: Can be fixed to surfaces or educational racks.
INTERACTION AND PROCESSING SOFTWARE

• User-friendly graphical interface: Makes it easy to read sensors and write to actuators.
• Integration with Python: Allows interaction of AI models in TensorFlow directly from the
software.
• Real-time processing: Collects data from sensors and transmits it quickly to AI.
• Feedback system: Receives AI outputs and translates them into commands for actuators.
• Data logging: Saves information for further analysis or training of new models.
• Scalability: Supports multiple sensors and actuators for complex systems.
• They teach how to automate processes through AI.
• They simulate practical solutions to industrial problems.
• They convert processed data into useful answers.

- They integrate theoretical learning with visible results.
- They encourage creativity in the design of intelligent systems.
- They encourage he is understanding of the impact of AI on automation.

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SOFTWARE APPLICATIONS

Path programming

This system allows for analyzing the behaviour of the A* algorithm,

which is key to several industrial processes, such as:

- Route optimization.
- Robot movement with obstacle avoidance.

It is based on the management of Euclidean distances and is ideal for
exploring intelligent algorithms.
The application operates on the server and uses technology that
students will review within the scope of the lab.
Associated knowledge areas:
• Route planning and optimization.
• Database construction.
• Information management (SQL).
Associated practices:
• Implementation of web services in Python.
• Algorithm programming in Python.
• Communications with external systems.
• Information management and IoT storage.
• Generation of information models for AI.
• ETL (Extraction, Transformation, and Loading) from applications
built in the lab.

- Implementation of web services for information exchange.

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Web Server publisher

This system allows the generation of different web services to exploit the

main database. It is a practical tool for exploring the extraction of

information contained in a database, exemplifying what happens in a

real-life industrial scenario.

Customized web services are stored in the database to be exploited

whenever required.

Associated knowledge areas:

- Data extraction and querying.
- Interacts with different platforms.

Associated practices:

- Information exploitation.
- Data management in JSON format.
- Development of communication interfaces for information

reading (M2M).

Data Base Cloning

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This system allows for the creation of copies of the main database.

Students can work with the information contained therein and modify it
according to their needs to execute the various experiments carried out
in the laboratory. Additionally, it provides the ability to develop
knowledge of database management and is also an important tool for
Information Technology Engineers. **This system resides on the laboratory**
server.
Associated knowledge areas:
• Database design,
• Database construction,
• Information management (SQL).
Associated practices:
• Information management and IoT storage,
• Generation of information models for AI,
• ETL (Extraction, Transformation, and Loading) from applications

built in the laboratory,

- Implementation of Web services for information exchange.

Python

This environment allows for the development of applications using the

Python programming language. Students can create custom scripts for

task automation, data analysis, and interaction with sensors, actuators,

or web services, depending on the requirements of each experiment

conducted in the lab.

Additionally, Python provides a powerful and versatile platform for

developing skills in structured and object-oriented programming, making

it an essential tool for engineers in the fields of automation, artificial

intelligence, and information technology.

This environment is installed locally and can be integrated with other lab systems.

Associated knowledge areas:

- Programming logic.
- Data structures.
- Object-oriented programming.
- Process automation.

Associated practicals:

- Development of scripts for data acquisition and processing.
- Automation of tasks in the lab.

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- Interaction with hardware through libraries such as pyserial, gpiozero, or RPi.GPIO.

- Implementation of machine learning algorithms and data

analysis using pandas, numpy, and scikitlearn.

- Building applications with graphical interfaces or web servers

using Flask.

TensorFlow

MySQL

OpenCV

SENSORS AND ACTUATORS

The **sensor module** includes the following components:

- Ultrasonic distance sensor,
- Laser distance sensor (LiDAR),
- IMU (Inertial Measurement Unit) sensor,
- Color sensor,
- Pressure sensor,
- Light intensity sensor,

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- Humidity and temperature sensor,
- Current sensor,
- Camera sensor.

The **UDP Sensor module (Wi-Fi or IoT)** includes the following components:

- Pressure sensor,
- Light intensity sensor,
- Humidity and temperature sensor,
- Current sensor.

The **actuator module** includes the following components:

- DC motor,
- Servomotor,
- Keypad,
- RGB Led,
- Matrix Led,
- Stepper motor,
- LCD I2C,
- OLED,
- Peltier cell.

TRAINING OBJECTIVES

The final users can be able to perform the following exercises:

- Programming Anti-blocking routines (avoid information loss).

- Programming using RTOS routines.
- Use of CPU and GPU.
- PID control programming.
- Control programming using neural networks.
- Creation of data sets (taking information from web service).
- Integration of information to database for dataset generation (advanced JSON management)
- Color detection.
- Object tracking.
- Creation of filters in the camera in real time.
- Development of pathfinding and planning solution.
- Machine Learning with humidity, temperature, pressure and lighting
- Supervised learning for temperature calculation.
- Control of motor speed based on distance.

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MAIN BASIC CONFIGURATION (20 students)*

• **1 x DL AI-2.0** – **AI** Main configuration (Hardware system, Server, Software's, and Applications) (for 3

students).

• **17 x DL AI-2.0SW**. (for 17 students)

EXAMPLES FOR OTHER CONFIGURATIONS*

If the laboratory includes less than 20 students (i.e. **15 students**), it will be necessary to have:

• **1 x DL AI-2.0**. (for 3 students)

• **12** x **DL AI-2.0SW**. (for 12 students)

If it includes 30 students, it will be necessary to have:

• **2** x **DL AI-2.0.** (for 6 students)
• **24** x **DL AI-2.0SW**. (for 24 students)
If it includes 40 students, it will be necessary to have:
• **2** x **DL AI-2.0**. (for 6 students)
• **34** x **DL AI-2.0SW**. (for 34 students)
If it includes 50 students, it will be necessary to have:
• **3** x **DL AI-2.0**. (for 9 students)
• **41** x **DL AI-2.0SW**. (for 41 students)
If it includes 55 students, it will be necessary to have:
• **3** x **DL AI-2.0**. (for 9 students)
• **46** x **DL AI-2.0SW**. (for 46 students)
If it includes 60 students, it will be necessary to have:
• **3** x **DL AI-2.0**. (for 9 students)
• **51** x **DL AI-2.0SW**. (for 51 students)

***: even the three students who work with the HW need their own PC,**

and DL AI-2.0SW is a single license for the expansion of the basic

hardware configuration.

Skip to main content

1

English

LABORATORY FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE

DL AI-2.0

This didactic laboratory **DL AI-2.0** for the development of **Artificial Intelligence** solutions is a state-of-the-art platform designed to provide practical and complete experience in the development of Artificial Intelligence solutions. With software and hardware that allow students to illustrate real-life scenarios, they will develop a comprehensive understanding of problem-solving from an **AI** perspective.

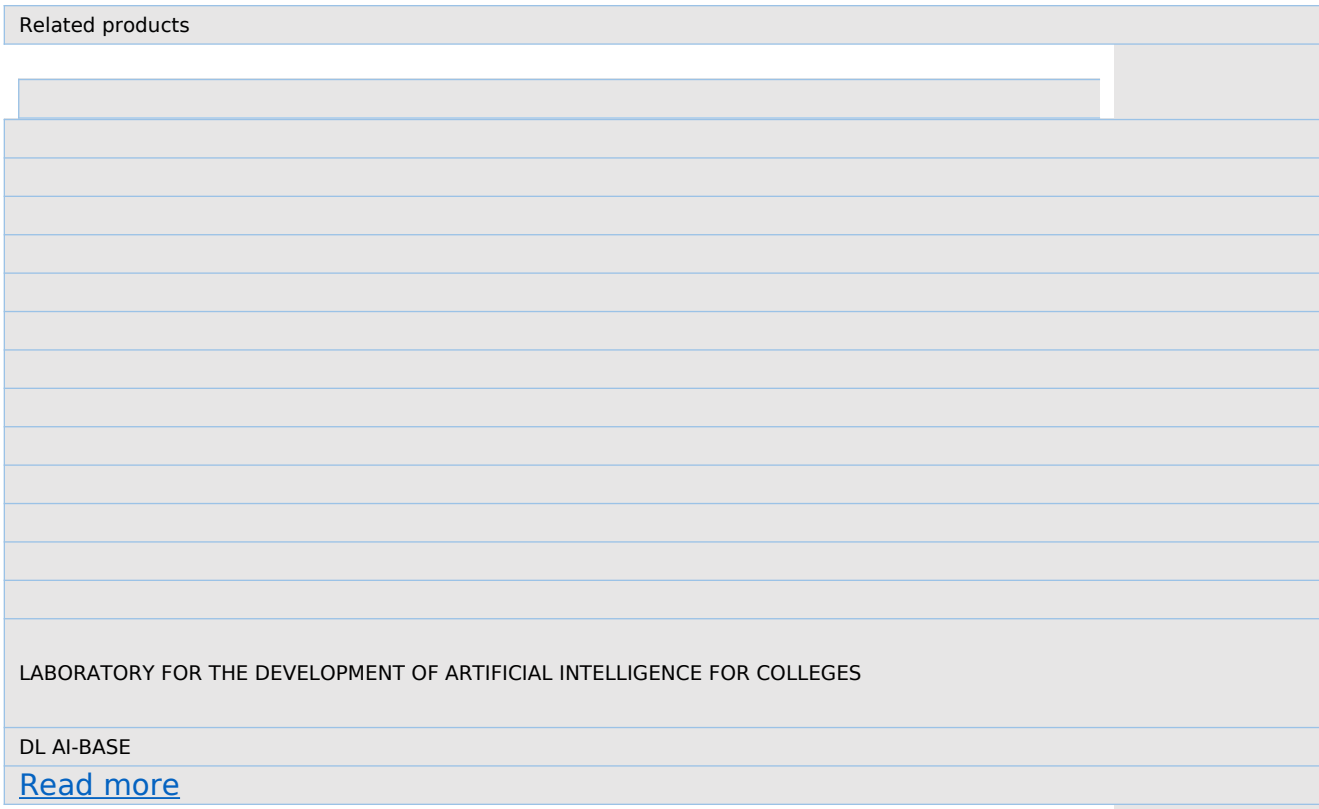
Catalogue

Video

Product added to list

Go to the list

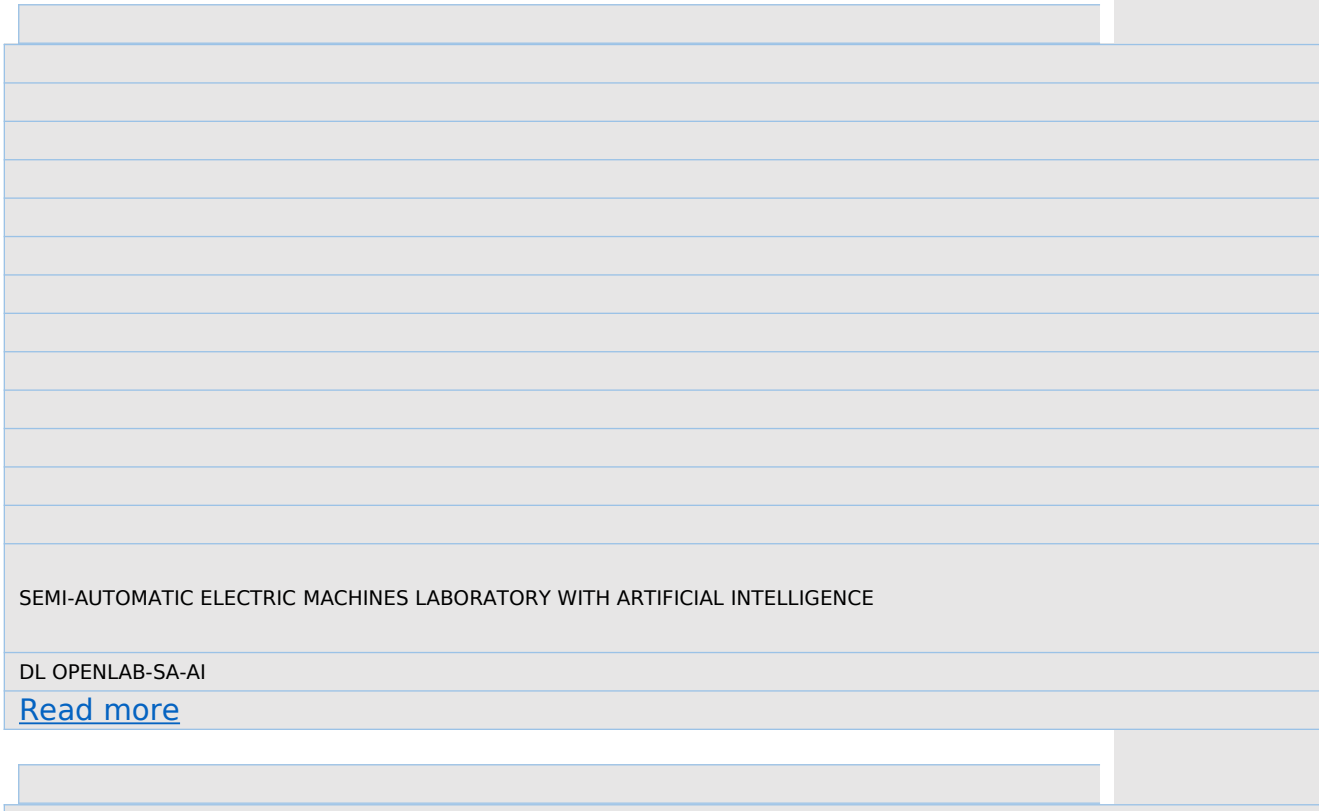
Related products



LABORATORY FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE FOR COLLEGES

DL AI-BASE

Read more



SEMI-AUTOMATIC ELECTRIC MACHINES LABORATORY WITH ARTIFICIAL INTELLIGENCE

DL OPENLAB-SA-AI

Read more

SMART GRID ENHANCED WITH ARTIFICIAL INTELLIGENCE

DL SGWD-AI

Read more

EQUIPMENT SYSTEM FOR THE STUDY OF INDUSTRY 4.0 “SMART FACTORY” ENHANCED WITH ARTIFICIAL INTELLIGENCE

DL I4.0 FACTORY-AI

Read more

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This is why we are constantly looking at developing new products

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On Mon, Jul 28, 2025 at 12:05 PM tshingombe fiston <tshingombefiston@gmail.com> wrote:

Introduction

The courses presented at Northlink College are career-orientated to bridge the gap between the workshop and the world of work with the least disruption at the end of the training period. Students who attend the simulated training are expected to wear the required safety attire (Helmet, Safety Shoes and an overall) at all times. The Competency Based Modular Training (CBMT) is the first stage in your career path that will allow the student to attain artisan status by successfully completing a trade test, after the prescribed work-based (on-site) experience accredited by the MERSETA, MAPPSETA, CHIETA, ESETA, AgriSETA. Note that the mentioned SETAs has the authority to approve your work-based experience.

General

Accretided Trade Test Centre for Electrician (MERSETA)

Career Opportunities

Apprenticeships in Trades

Learnership in Trades

Self Employment

Admission Requirements

Grade 9 or equivalent qualification

PHASE 1

Curriculum

BSFI I Safety Act; BSF2 I Basic Safety; BSF3 I Colour Marking and S-Signs; BHTI I Identify Tools and Tooling Aids; BHT2 I Use Tools and Tooling Aids; BHT3 I Maintain Tools and Tooling Aids; BHT4 I Use Hand Tools Applicable to Trade; BWTI I Use fixed and portable drilling machines; BWT2 I Use fixed and portable grinding machines; BWT3 I Use portable Jigsaw; BMOI I Fabricate saddles; BM02 I Fabricate busbar; BM03 I Fabricate Multi-spanner; BHS I I Sharpen Chisels; BHS2 I Dress Screwdrivers; BHS3 I Sharpen punches; BSS I I Solder Various projects; BEMI I Electrical Symbols; BEM2 I How potential energy is stored; BEM3 I Colour Resistance; PANI I Multimeters PAN2 I Relay; PAN3 I Connect 2 lights/2 switches; PAN4 1 Two way; PAN5 1 Intermediate switch

PAN6 1 Photo cell; PAN7 1 Row Control; PAN8 1 Resistance Boxes; PAN9 1 Three Heat Stove Switch; PANIO 1 Five Heat Stove Switch; PAN 1 1 Simmerstat; PANI2 1 Piano Switch; PAN 13 1 Contactors; PANI4 1 Stop/Start Emergency; PAN1344 1 Forward/reverse single phase motor; PAN14 1 Pilot Lamps; PAN15 1 Single phase; PANI6 1 Earth Leakage-Circuit Breakers; PANI7 1 Different Lights PANI8 1 Timers

PHASE 2

Curriculum

BIN1 Installation (metal & pvc); BIN2 Installation (ducting & conduit); BCA1 Make-off & join armoured cable; BCA2 Identify ratings of cables (theory); BCA3 Recall methods of storing cables (theory); BCA4 Terminate PVC cables (by means of glands); BCA5 Identify .x•lp cables (theory); BC01 Current carrying capacity of conductors (theory); BC02 Join conductors (cable joints); BC03 Insulate conductors (cable joints); BMJ1 Select and connect meters (various types); BET1 Electrical testing (installation and motors); BD1 AC & DC on an oscilloscope (theory); BD2 Induction & self induction (theory); BD3 Three phase and single phase supplies (theory); BD4 Calculate transformer dimensions (theory); BD5 Capacitance in AC & DC circuits (theory); BD6 Power in AC circuits (theory); BD7 Motors, single, three phase, phasing & starting; BD8 Construct AC switching circuits (1 way, 2 way); BD9 Switching circuits via contactor (energy metres); BFA1 Fault finding BW1 Wiring from drawings; BAC1 Connect AC machines (1 phase & 2 phase); BAC2 Test AC machines; BAC3 Fault find AC machines; BDC1 Connect DC machines (series, shunt, compound); BDC2 Test DC machines; BDC3 Fault find DC machines; BEL 1 Three phase forward & reverse starter; BEL2 Single phase forward & reverse starter; BEL3 Star delta starter; BEL4 Direct online starter; BEL5 Sequence Starter; BEL6 Autotransformer Relay Panel; BEL7 Resistance Starter

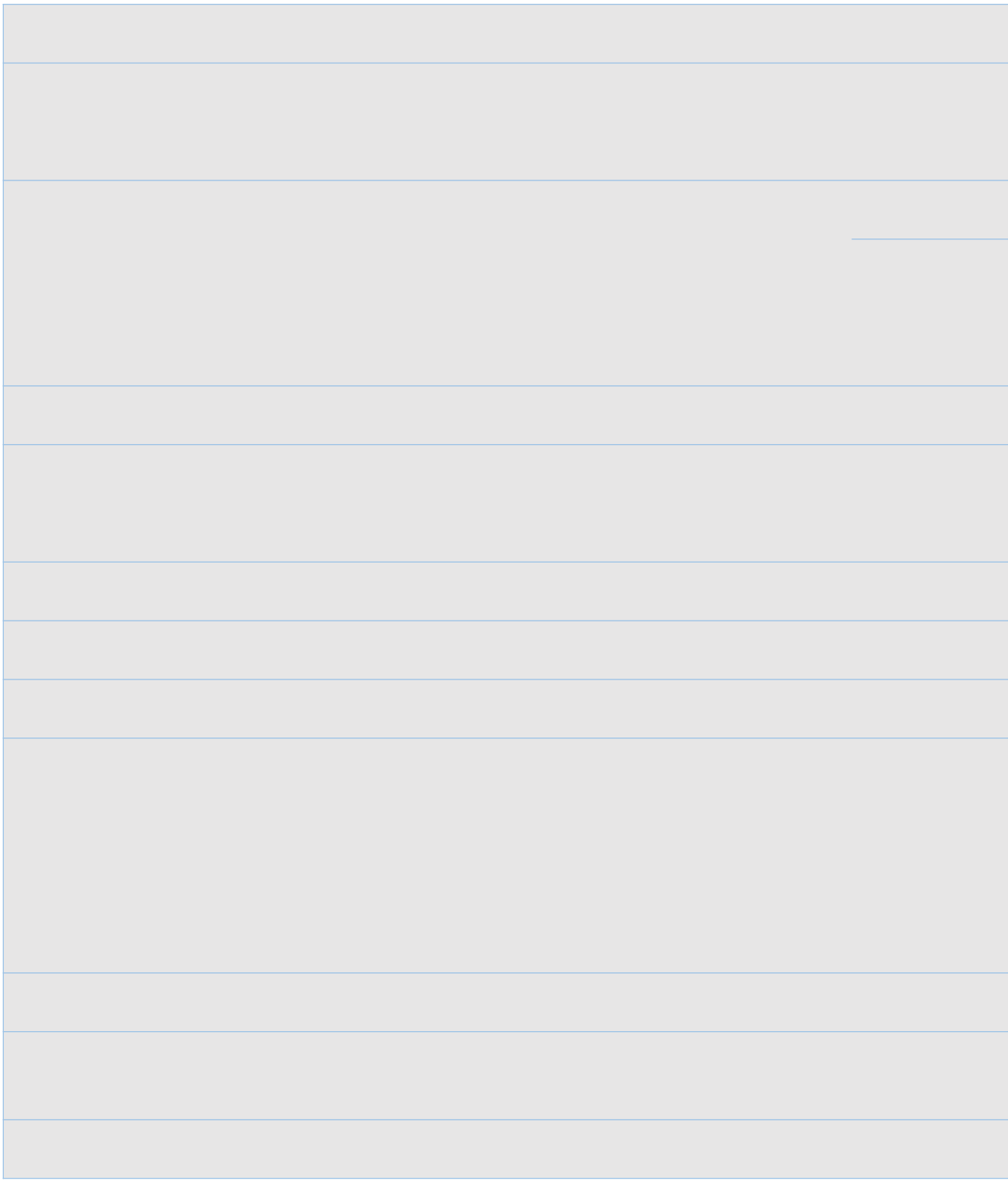
PHASE 3

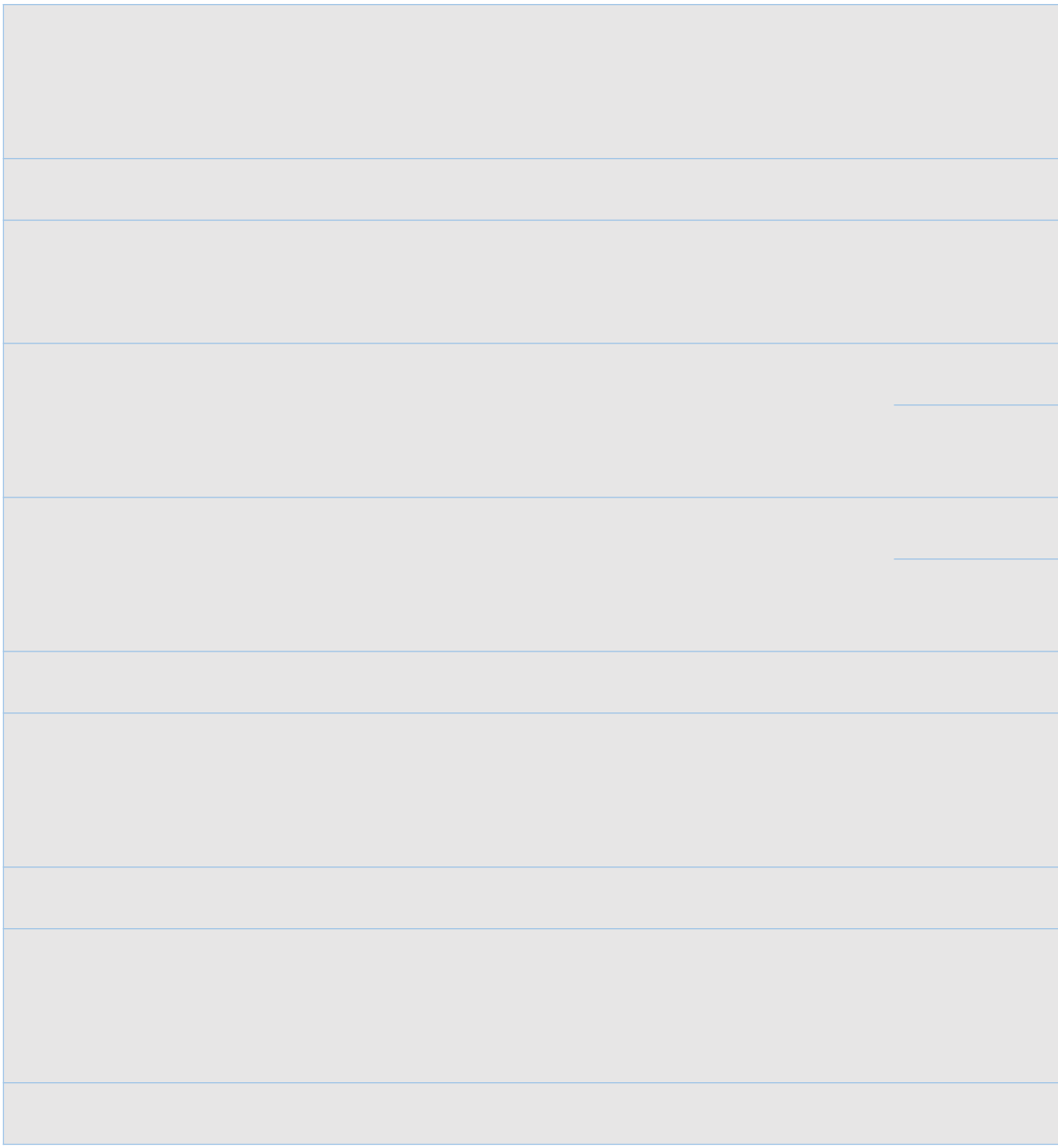
Curriculum

AC16 Transformer basics & transformer types; AC9 Single phase forward/reverse with selector switch (with overload tip); AC16 Transformer connections & calculations; EL4 Electronic start for single phase motor; AC10 Auto transformer starter; AC10 2-Speed motor starter (with contactors); AC16 Potential & current TRF. (PT & CT Panel); AC10 2-Speed motor starter with selector switch; L2 Using a bread board DC1 DC motor testing and connections; EL1 Resistors, capacitators, snubber network; EE1 Maintain, repair & test electrical equipment; EL1 Diodes, bridge RECT., zener diodes, LEDs, etc. WI1 kWh Metersel1 bi-polar transistors; A04 Tack & arc weld work pieces; EL1 MOSFETs & IGBTs

EL1 Unijunction transistor; EL1 Thyristors: SCR, TRIAC, DIAC etc; EL1 OPTO-Couplers; EL1 Solid state relay application ANPROC analogue processing-siemens; EL2 OP-AMP AS COMPARATOR EL5 PROGRAM & USE PLC; DC1 Testing and connection of DC motor element – External and local expandable modules-x100 moeller; AC11 Resistance starter (Automatic) GEOAD – Geographical Addressing-siemens/moeller; AC17 Slipring motor test GIS – General Introduction to systems-s7-200/s7-1200 siemens DC1 DC Drive principles (Power circuit) hardcon – Hardware configuration-s7-200/easysoft advance task; AC11 AC Drive principles (power circuit) introduction; FB – Introduction to function blocks-siemens/moeller advance; EL2 Vero-board project(s) IPLC – advance PLC task1-10; SS2 Printed circuit board production & project practical; FF – Advance practicle fault finder; ET1 Using the osciliscope; EEL3 Test@ – Oscilloscope measurements 1

14 attachments — Download all attachments





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MEDIA DEVELOPMENT COMMITTEE MEMBERS

Shri. T. Muthu	–	Principal (Retd.), MDC Member. NIMI, Chennai
Shri. C.C. Jose	–	Training Officer (Retd.), MDC Member, NIMI, Chennai
Shri. K. Lakshmanan	–	Assistant Training Officer (Retd.), MDC Member, NIMI, Chennai.

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Shri. V. Gopalakrishnan	–	Assitant Manager, NIMI, Chennai - 32

NIMI records its appreciation for the Data Entry, CAD, DTP operators for their excellent and devoted services in the process of development of this Instructional Material.

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INTRODUCTION

This manual for trade Theory is intended for use in the ITI classoom. It consists of a series of practical exercises that are to be completed by the trainees during the first semester of course is the **Electrician trade under Electrical Sector. It is National Skills Qualifications Framework (NSQF) - (LEVEL 5),** supplemented and supported by instructions/information to assist the trainees in performing the exercises. The syllabus for the 1st Semester **Electrician NSQF (LEVEL - 5)** Trade under **Electrical Sector** Trade Practical is divided into Six Modules. The allocation of time for the various modules is given below:

Module 1: Safety Practice and Hand Tools	14 Exercises	75 Hrs
Module 2: Basic Workshop Practice (Allied Trade)	09 Exercises	100 Hrs
Module 3: Wires, Joints - Soldering - U.G. Cables	10 Exercises	125 Hrs
Module 4: Basic Electrical Practice	11 Exercises	75 Hrs
Module 5: Magnetism and Capacitors	08 Exercises	50 Hrs
Module 6: AC Circuits	12 Exercises	100 Hrs
Total	64 Exercises	525 Hrs

The syllabus and the content in the modules are interlinked. As the number of workstations available in the electrical section is limited by the machinery and equipment, it is necessary to interpolate the exercises in the modules to form a proper teaching and learning sequence. The sequence of instruction is given in the schedule of instruction which is incorporated in the Instructor's Guide. With 25 practical hours a week of 5 working days 100 hours of practical per month is available.

The procedure for working through the 64 exercises for the 1st semester with the specific objectives to be achieved as the learning out comes at the end of each exercise is given in this book.

The symbols used in the diagrams comply with the Bureau of Indian Standards (BIS) specifications.

This manual on trade Theory forms part of the Written Instructional Material (WIM). Which includes manual on trade theory and assignment/test.

CONTENTS

Lesson No.	Title of the Lesson	Page No.
	Module 1: Safety practice and hand tools	
1.1.01	Organization of ITI's and scope of the Electrician trade	1
1.1.02 & 1.1.03	Safety rules - Safety signs - Hazards	4
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1.1.06 & 1.1.07	Rescue operations - First aid treatment - Artificial respiration	15
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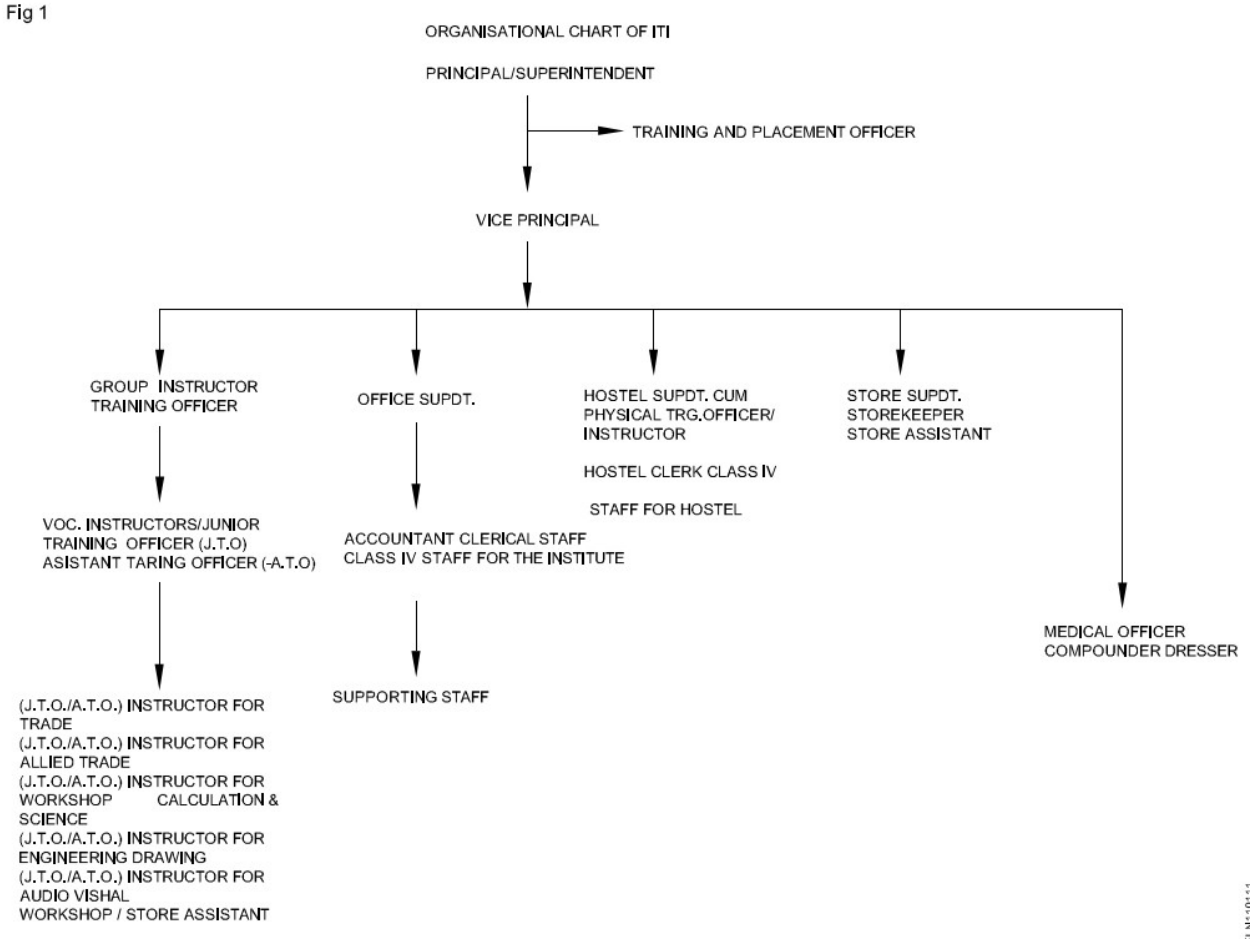
Week No.	Ref. Learning Outcome	Professional Skills(Trade Practical) with Indicative hours	Professional Knowledge (Trade Theory)
1.	• Apply safe working practices • Install and setup operating system and related software in a computer.	**Safe working practices** 1. Visit various sections of the institutes and location of electrical installations. (05 hrs) 2. Identify safety symbols and hazards. (05 Hrs) 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. (05 hrs) 4. Practice safe methods of fire fighting in case of electrical fire. (05 hrs) 5. Use of fire extinguishers. (05 Hrs)	Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers
2.	• Install and setup operating system and related software in a computer.	6. Practice elementary first aid. (05 hrs) 7. Rescue a person and practice artificial respiration. (05 Hrs) 8. Disposal procedure of waste materials. (05 Hrs) 9. Use of personal protective equipments. (05 hrs) 10. Practice on cleanliness and procedure to maintain it. (05 hrs)	First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc
3	• Prepare profile with an appropriate accuracy as per drawing	11. Identify trade tools and machineries. (10 Hrs) 12. Practice safe methods of lifting and handling of tools & equipment. (05 Hrs) 13. Select proper tools for operation and precautions in operation. (05 Hrs) 14. Care & maintenance of trade tools	Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011

4 - 5	• Prepare profile with an appropriate accuracy as per drawing	15. Operations of allied trade tools. (05 Hrs) 16. Workshop practice on filing and hacksawing. (10 Hrs) 17. Prepare hand coil winding assembly. (5 Hrs) 18. Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (15 Hrs) 19. Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15 Hrs)	Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints
6 - 7	• Prepare profile with an appropriate accuracy as per drawing	20. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (10 Hrs) 21. Workshop practice on drilling, chipping, internal and external threading of different sizes. (20 Hrs) 22. Practice of making square holes in crank handle. (5 Hrs) 23. Prepare an open box from metal sheet. (15 Hrs)	Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges Types, Uses, Care and maintenance. Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools
8	• Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable	24. Prepare terminations of cable ends (02 hrs) 25. Practice on skinning, twisting and crimping. (15 Hrs) 26. Identify various types of cables and measure conductor size using SWG and micrometer. (8 Hrs)	Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison
9 - 10	• Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of under ground cable	27. Make simple twist, married, Tee and western union joints. (18 Hrs) 28. Make britannia straight, britannia Tee and rat tailjoints. (18 Hrs) 29. Practice in Soldering of joints / lugs. (14 Hrs)	Joints in electrical conductors. Techniques of soldering. Types of solders and flux

Fig 1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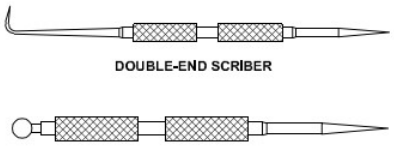
PRINCIPAL/SUPERINTENDENT
TRAINING AND PLACEMENT OFFICER
VICE PRINCIPAL
GROUP INSTRUCTOR
TRAINING OFFICER
OFFICE SUPDT.
HOSTEL SUPDT. CUM
PHYSICAL TRG.OFFICER/
INSTRUCTOR
HOSTEL CLERK CLASS IV
STAFF FOR HOSTEL
STORE SUPDT.
STOREKEEPER
STORE ASSISTANT
VOC. INSTRUCTORS/JUNIOR
TRAINING OFFICER (J.T.O)
ASISTANT TARING OFFICER (-A.T.O)
ACCOUNTANT CLERICAL STAFF
CLASS IV STAFF FOR THE INSTITUTE
MEDICAL OFFICER
COMPOUNDER DRESSER
(J.T.O./A.T.O.) INSTRUCTOR FOR
TRADE
(J.T.O./A.T.O.) INSTRUCTOR FOR
ALLIED TRADE
(J.T.O./A.T.O.) INSTRUCTOR FOR
WORKSHOP CALCULATION &
SCIENCE
(J.T.O./A.T.O.) INSTRUCTOR FOR
ENGINEERING DRAWING
(J.T.O./A.T.O.) INSTRUCTOR FOR
AUDIO VISHAL
WORKSHOP / STORE ASSISTANT
SUPPORTING STAFF

Fig 1



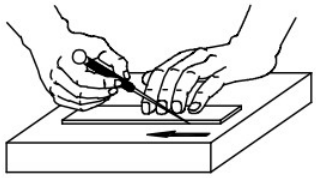
DOUBLE-END SCRIBER

PLAIN SCRIBER

ELN'21'471

Uses: Used for scribing lines on the metal being laid out. (Fig 2)

Fig 2



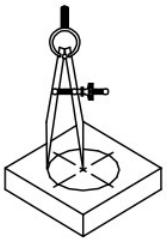
SCRIBING LINES

ELN'21'472

Uses: A divider is used for

- measuring distances between points
- transferring measurements directly from a rule
- scribing circles and arcs on metals. (Fig 3)

Fig 3



SCRIBING CIRCLES

ELN'21'473

Radius gauges

Objectives: At the end of this lesson you shall be able to

- **state the uses of radius gauges**
- **state the features of radius gauges.**

Radius gauges: Radius gauges are used to check the internal and external radius of workpieces.

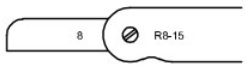
These gauges are made of high quality steel sheets and are finished to accurate radius.

The radius of parts are checked by comparing the radius of the gauges.

Radius gauges are available in sets of several blades held in a holder. Each blade can be separately pulled out of the holder when in use.

The size of the radius is marked on individual blades of the gauges. (Fig 1)

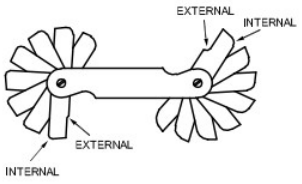
Fig 1



BLADE OF RADIUS GAUGE

ELN'21'481

Fig 2



RADIUS GAUGE

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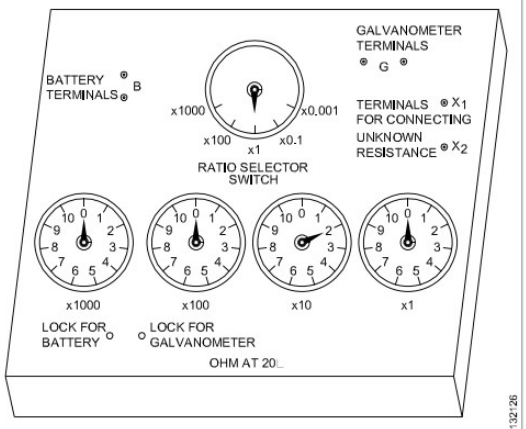
multimeter. There are various methods to determine the ohmic value of resistance. Some of these methods will be explained later in this book.

Fig 6



WHEATSTONE BRIDGE

$Q = I \times t$

Coulomb

It is the quantity of electricity transferred by a current of one ampere in one second. Another name for the above unit is the ampere-second. A larger unit of the quantity of electricity is the ampere-hour (A.h) and is obtained when the time unit is in hours

1 A.h = 3600 Asec or 3600 C

Types of electrical supply

Objectives: At the end of this lesson you shall be able to

- **explain the difference types of electrical supply**
- **differentiate between alternating current and direct current**
- **explain the method of identification of polarity in DC source**
- **state the effect of electric current**

There are various types of instruments working on different principles. Each instrument is designed to measure a particular electrical quantity or more than one quantity with suitable modification and necessary instruction. Further they may be designed to measure AC or DC supply quantities or can be used in either supply.

To enable proper use of the instruments, the technician should be able to identify the type of supply with the help of the details given below.

Type of electrical supply (Voltage)

There are two types of electrical supply in use for various technical requirements. The alternating current supply (AC) and the direct current supply (DC).

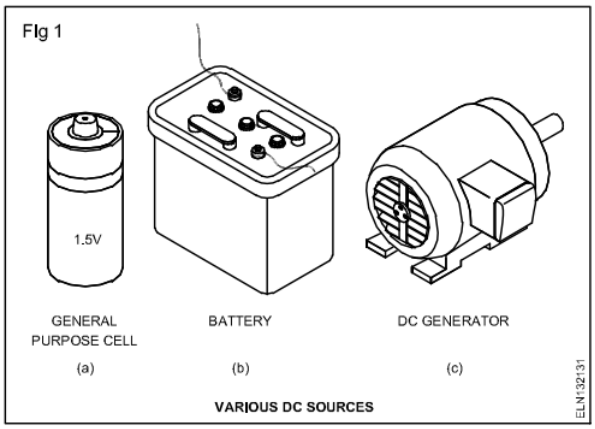
⎓ DC is represented by this symbol.

~ AC is represented by this symbol.

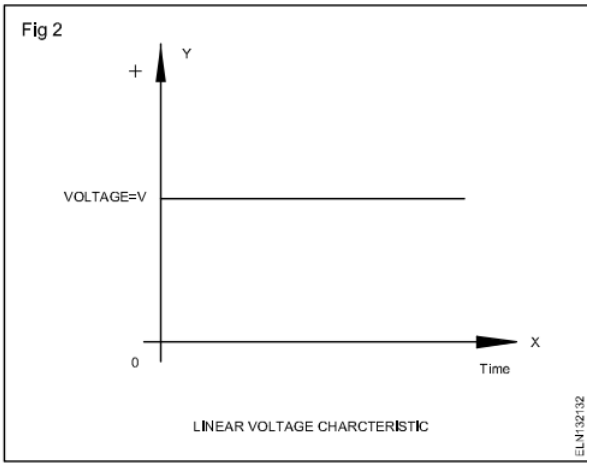
DC Supply

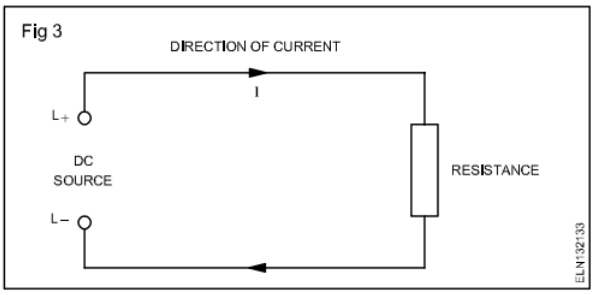
The most common sources of DC supply are the cells/ batteries (Figs 1a and 1b) and DC generators (dynamos). (Fig 1C)

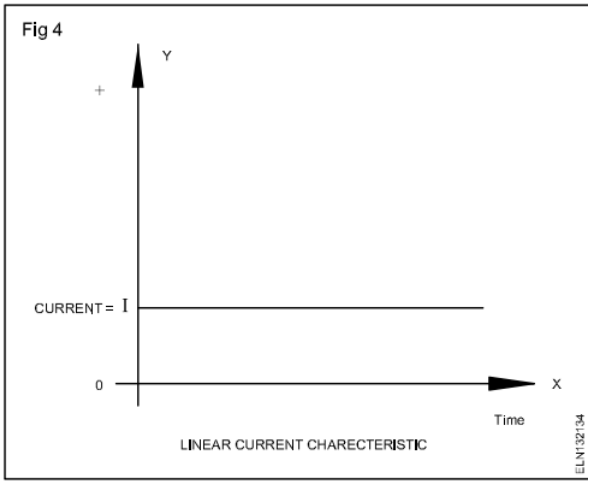
Direct voltage is of constant magnitude (amplitude). It remains at the same amplitude from the moment of switching on to the moment of switching off. The polarity of the voltage source does not change. (Fig 2)



The polarity of direct voltage (commonly known as DC voltage) is positive (+ve) and negative (–ve). The direction of conventional flow of current is taken as from the positive

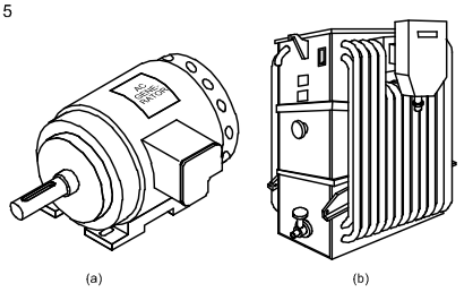






Thus direct current remains at the same value from the

Fig 5



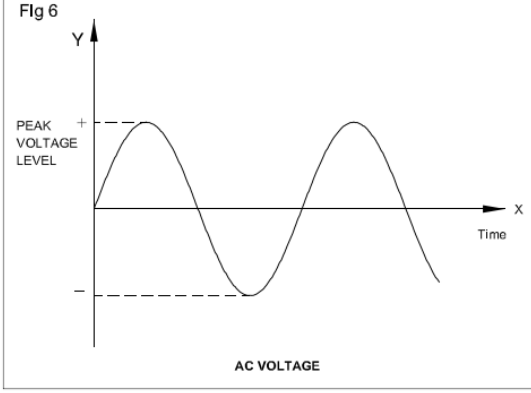
VARIOUS AC SOURCES

ELN132135

Alternating voltage

AC supply sources change their polarity constantly, and consequently the direction of voltage also magnitude. The voltage supplied to our homes by power plants is alternating. Fig 6 shows a sinusoidal alternating voltage over time (wave-form).

Fig 6



AC VOLTAGE

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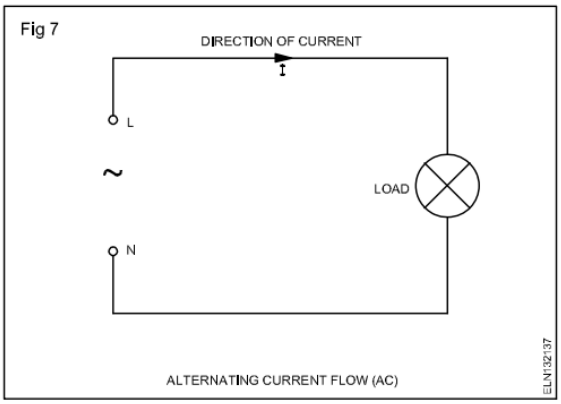
AC supply is expressed by the effective value of the voltage, and the number of times it changes in one second is known as frequency. Frequency is represented by 'F' and its unit is in Hertz(Hz).

For example, the AC supply used for lighting is 240V 50 Hz. (Alternating voltage in common use is known as AC voltage.) AC supply terminals are marked as phase/line(L) and neutral(N).

Current is caused in an electric circuit due to the application of voltage. If an alternating voltage is applied to an electrical circuit, an alternating current (commonly known as AC current) will flow. (Figs 7 and 8)

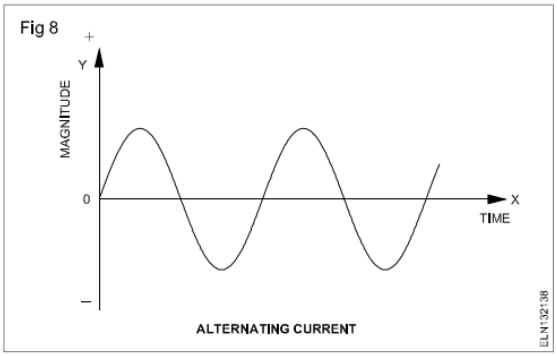
Fig 7



ALTERNATING CURRENT FLOW (AC)

ELN132137

Fig 8



ALTERNATING CURRENT

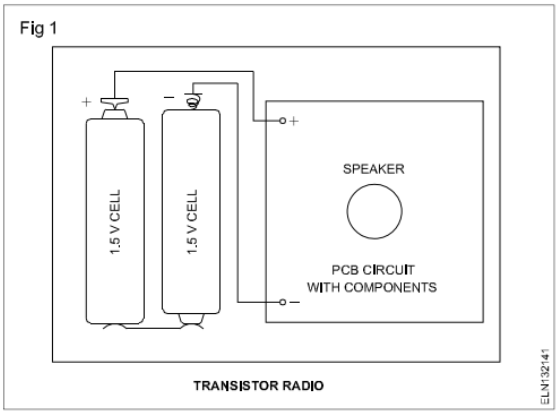
ELN132138

Polarity test in DC

Polarity

The polarity of a DC supply source should be identified as positive or negative. We can also use the term to indicate how an electric device is to be connected to the supply. For example, when putting new cells in a transistor radio we must put the cells correctly such that the positive terminal of one cell connects to the positive terminal of the radio and the negative terminal of the other cell connects to the negative terminal of the radio as shown in Fig 1.

Fig 1



TRANSISTOR RADIO

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